Compressed Air Magazine

AUGUST 1961

IN THIS ISSUE:
BUILDING BOATS
DEMOLISHING DAMS
COMPOUNDING PERFUMES
SHOOING SHARKS

GET REAL PRODUCTIVITY—GET A GM DIESEL

Put a Diesel to work driving a compressor in a bath of flying, abrasive dust and you've given it about the toughest working atmosphere you can find.

Yet Stockbridge Stone Division of Vulcan Materials Co. at its Norcross, Georgia, quarry has a GM Diesel that's stood up to these conditions for four long years with only 1 overhaul.

What's more, Norcross Superintendent J. L. Wilkinson reports he has another "Jimmy" with 6,300 hours of service and still no overhaul and a third "6-71" with only one overhaul in 9,400 hours.

With overhauls few and far between, it's no wonder production is up, costs down. And Mr. Wilkinson reports he's making other savings, too.

For his company also has in its fleet 3-, 4-, and 6-cylinder GM Diesels in many applications requiring this speed engine —can use many of the same moving parts in all engines—saves on parts inventory, maintenance time, mechanic training.

Want long-lasting, reliable power for your compressors? Choose a clean-running "Jimmy" Diesel. Get the facts. Call your GM Diesel Distributor—he's part of a coast-to-coast network of "engine people" you'll find in the Yellow Pages under "Engines, Diesel"—or write direct.

GM DIESEL

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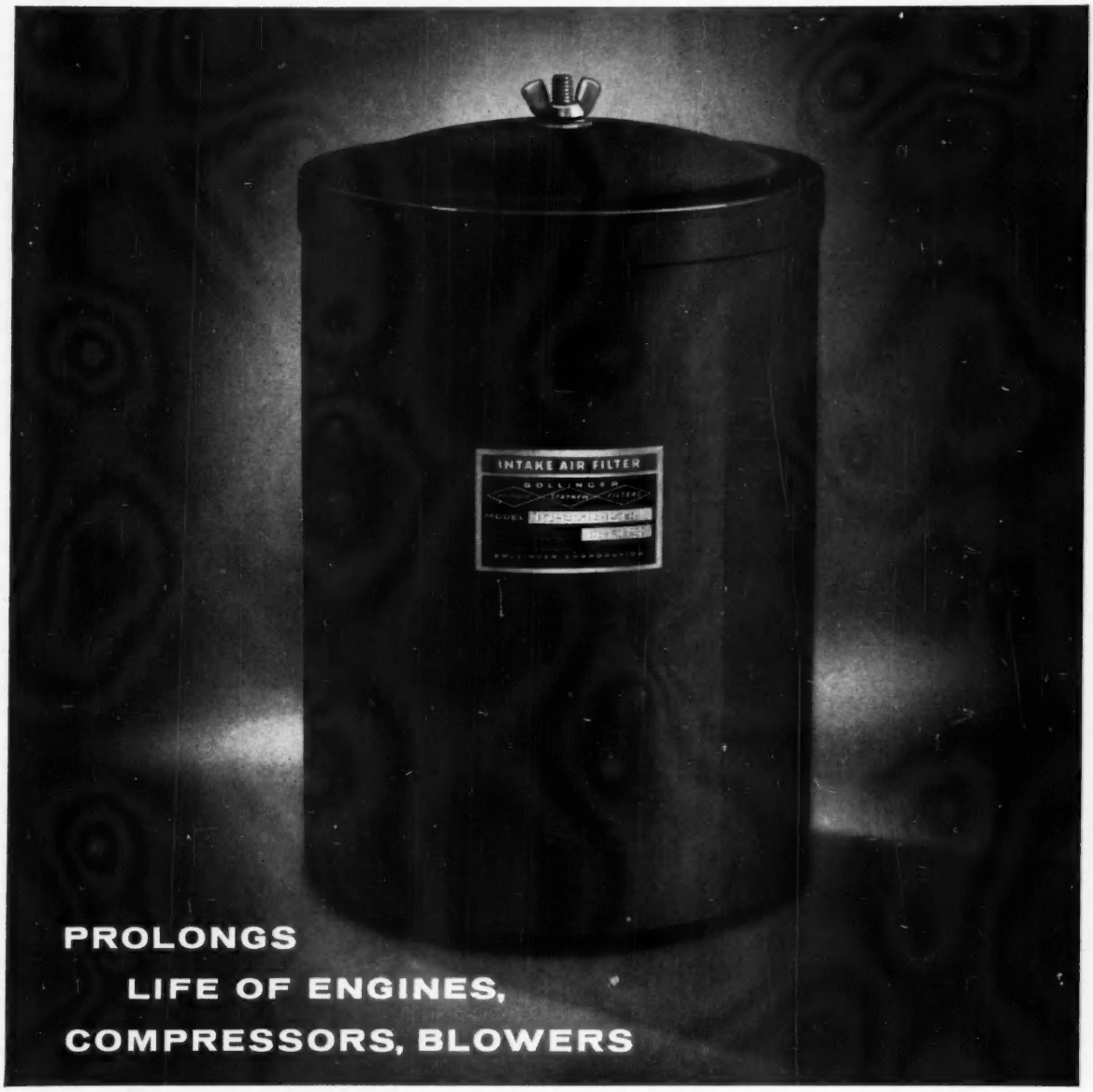
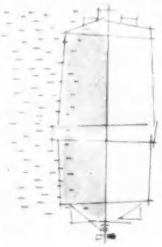
GM DIESEL ALL-PURPOSE POWER LINE sets the standard of Diesel productivity





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DRY FILTER
SPECIALISTS
FOR 40 YEARS

This Dollinger Staynew Intake Filter prevents needless wear and damage to the compressor by removing dust and abrasives before they enter the air intake.

In small (down to 60 CFM) and large (up to 20,000 CFM) capacities, Dollinger Staynew Filters work throughout industry to improve equipment performance by simple, efficient removal of foreign particles. Staynew Filters are easy to install, need practically no maintenance, and—when infrequent cleaning is necessary—are handled with little trouble. With the exclusive Radial Fin Insert, they offer the greatest active filtering area in any given space. If clean air is the answer to your engine, compressor or blower problems, ask about Staynew Intake Filters. Consult your local Dollinger representative, or write for Bulletin 100. Dollinger Corporation, Industrial Products Division, 7 Centre Park, Rochester 3, New York.

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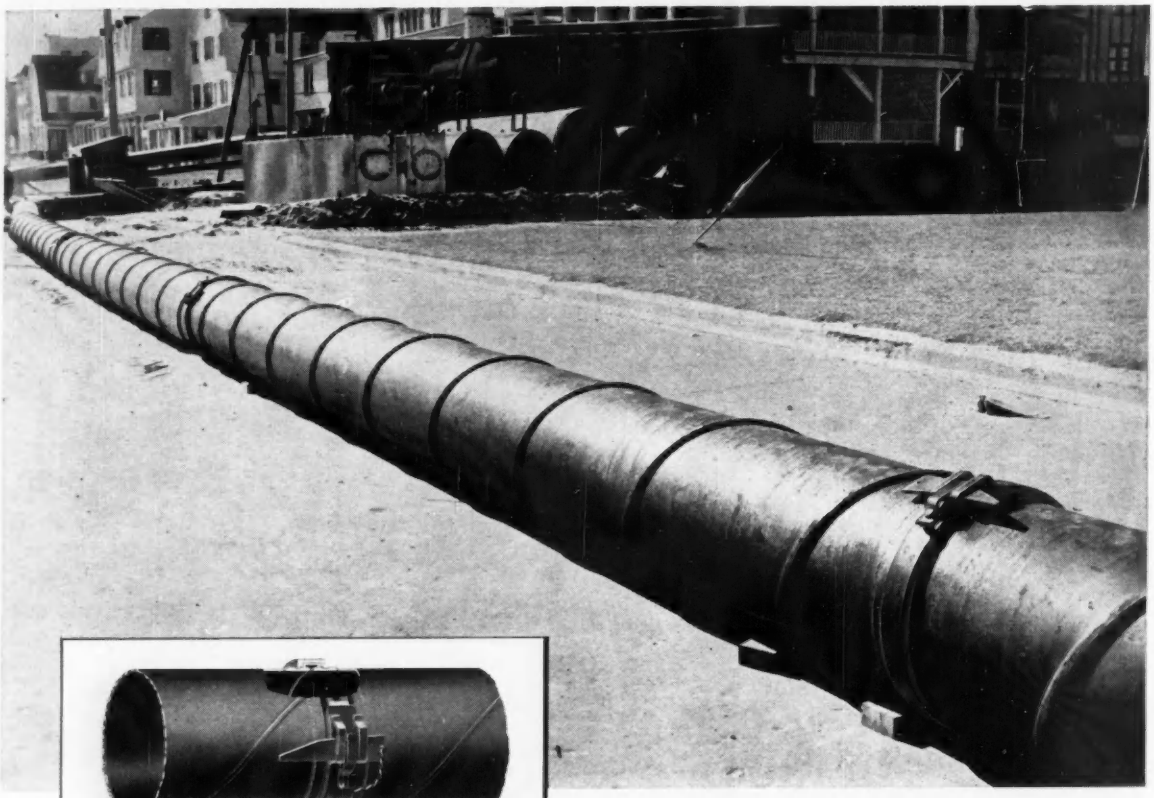
PARE YOUR PIPING COSTS
With This **NAYLOR** PAIR



NAYLOR Wedgelock couplings make a positive connection, securely anchored in standard weight grooved ends.

You can't find a better time and money-saving combination than NAYLOR Spiralweld pipe and NAYLOR Wedgelock couplings.

Your savings start with the light weight of the pipe, but there's no sacrifice of strength—thanks to the exclusive lockseamed-spiral-welded structure. Handling is simple; installation fast. Time savings continue with use of the Wedgelock coupling . . . the fastest and easiest method of connecting grooved-end pipe. A hammer is the only tool required to connect or disconnect it and lines can be made up with only one side of the pipe exposed.

For air, water or ventilating lines, get the cost-cutting facts on this NAYLOR combination. Write for Bulletin No. 59.

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Volume 66 Number 8

August 1961

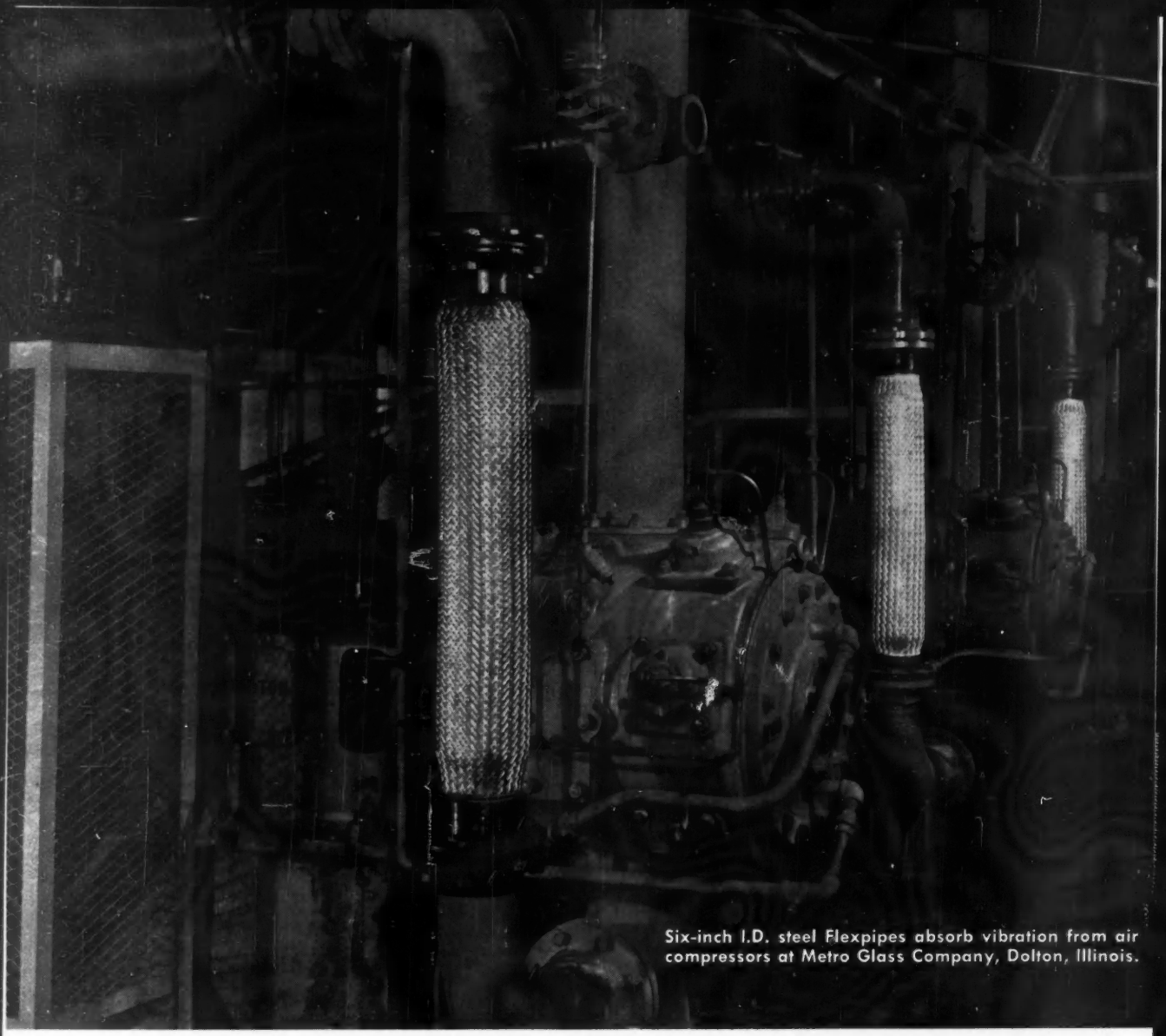
Compressed Air MAGAZINE

BPA

Editorial, advertising and publication offices: 942 Memorial Parkway, Phillipsburg, New Jersey. Annual subscription, United States and possessions, $5; foreign, $7; single copies, domestic $0.50, foreign, $0.70. Compressed Air Magazine is indexed in Industrial Arts Index and in Engineering Index. Microfilm volumes (1940 to date) are available from University Microfilms, Inc. Published monthly by Compressed Air Magazine Company: A. W. Loomis, President; L. C. Hopton, Vice President; C. H. Biers, Secretary-Treasurer.

on the cover

The reputation of a perfume chemical manufacturer rises and falls with the marriage of tones in the laboratory. Selecting, judging and blending the proper proportions of aromatics play important roles. Such physical tests as color, odor, solubility, specific gravity and refractive index are demanded along with chemical analysis. Some companies even use infrared, ultraviolet or vapor phase chromatography. But final acceptance or rejection of an aromatic compound is dependent on the perfumer's nose. Our cover shows an artist evaluating a new compound; the story behind his art begins on page 18.



Six-inch I.D. steel Flexpipes absorb vibration from air compressors at Metro Glass Company, Dolton, Illinois.

Flexpipe connectors by Anaconda

Soak up compressor vibration . . . prevent leakage and piping failures

Install Flexpipe connectors . . . and forget about potential damage from vibration. These flexible metal connectors have a core of either bronze, hot-dip galvanized steel, or stainless steel. For added strength, a wire braid covers the core. Because of their flexibility, Flexpipes are easy to install, even in cramped quarters . . . save labor and floor space . . . eliminate many elbows, couplings and nipples.

In addition to absorbing vibration, Flexpipes take up piping travel and connect outlets which do not line up. Available in sizes from ¼″ I.D. through 16″ I.D. from leading jobbers and plumbing supply houses. For more information, write to: Anaconda Metal Hose, P. O. Box 791, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.

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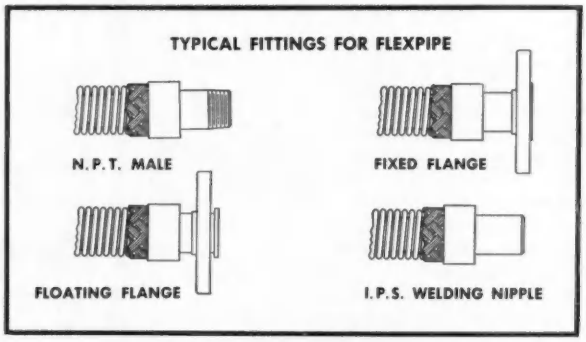

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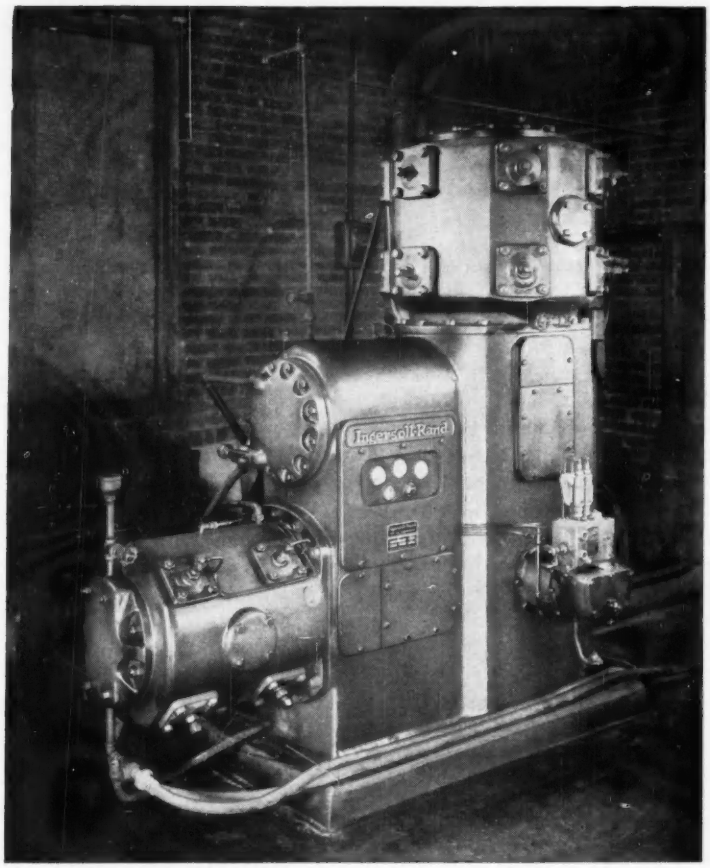

IN I-R COMPRESSORS,

TIME TELLS

THE DIFFERENCE

This XLE compressor has operated 24 hours a day for more than

63,648 HOURS

with no forced maintenance since installed in 1951

At the Conshohocken (Pa.) plant of the Lee Rubber & Tire Corporation, this Ingersoll-Rand XLE air compressor has operated at full load, 24 hours a day, six days a week, with no forced shutdowns since installed in 1951. At this writing, the unit has totalled 63,648 hours and is still going strong!

The only maintenance has been to check the valves once every three months on Sunday. This XLE operates as the plant's base-load air compressor, with the load variations being handled by another unit.

The XLE compressor had been purchased largely because of good performance of other I-R equipment in the same plant, including three different types of compressors and a variety of pumps.

The *extra value* that's built into every Ingersoll-Rand compressor pays off with *long-run economy*. Reduced maintenance and attention, over many years, mean long-range savings in the cost of air power. Ask your I-R representative to show you how to get your maximum *"Dividend on Payroll Dollars"* with a Planned Annual Review of your air power system.

***ONLY IR COMPRESSORS HAVE CHANNEL VALVES**

Known for high efficiency, quiet operation and exceptional durability. Entirely different. Each valve is a combination of rigid stainless-steel channels and bowed leaf springs, with trapped-air spaces which cushion action, prevent impact.

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THE WORLD'S MOST COMPREHENSIVE COMPRESSOR EXPERIENCE

The Making of a Boat

R. J. Nemmers

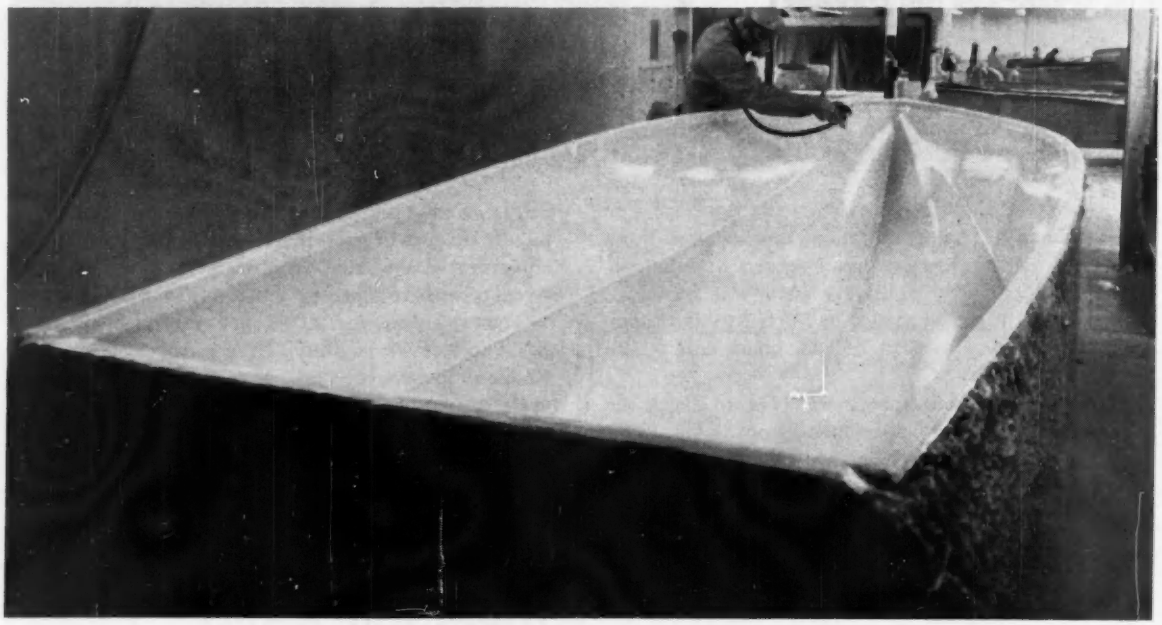
DORSETT Marine, Division of Textron, Inc., operates plants at Santa Clara and San Jose, Calif., Bremen, Ind., and Cambridge, Md. Each turns out sleek Iso-Glas* pleasure craft in a variety of sizes from 14-foot runabouts to 21-foot cabin cruisers. With the exception of the 18-foot Sea Hawk, all are designed for use with outboard motors. The Sea Hawk is a jet-powered craft using a 105-hp Ford Comet inboard engine. A pumping system draws water in through a screen in the after hull-bottom and discharges it at high pressure through a stern orifice.

Each of the outboard models has positive mechanical steering installed at the factory; a self-bailing motor well; a double-bottom and sections of foamed plastic for flotation safety; vinyl-covered foam-padded seats and (where required) mattresses; aluminum rub rails for dock-side protection; inside paint jobs that harmonize with the exterior color; and through-transom and double-bottom drain plugs. The Sea Hawk has the same features except it is steered by deflecting the water jet.

The company began business as Dorsett Plastics Corporation in Santa Clara in 1955. It became a division of Textron, Inc., in mid-1960. The firm has enjoyed a rapid growth, and now has distribution throughout the country. Because of the attractive appearance of its craft, and the wide price range—the lowest priced runabout sells for about $700, the most expensive cruiser, about $3700 and the Sea Hawk, about $3900—the fleet of Dorsett boats has ridden the crest of the current boating craze to good avail.

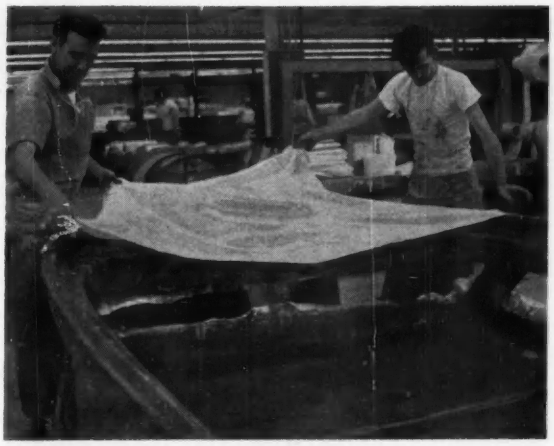
The Dorsett plant at Cambridge, Md., is the newest of the young firm's manufacturing facilities. The plant occupies a 35-acre plot, with 80,000 square feet under roof. The building is a single-story structure of concrete block with wide clear-span bays designed for virtual assembly-line manufacture of boats.

Making an Iso-Glas boat, believe it or not, begins with the finish surfacing material. The spraying process is called gel-coating. From this initial step to final buffing and polishing, pneumatic tools and air power are employed in about every phase. The accompanying pictures follow the fabrication of a Dorsett boat from start to finish and illustrate the uses of compressed air along the way.

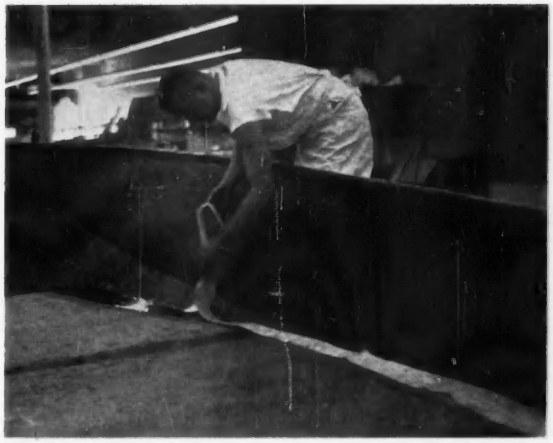


FIRST STEP in making a Dorsett Iso-Glas boat begins with mold preparation. The form is carefully waxed so that the gel-coat, laid down first, will not stick to it. This spraying is shown above. The finish is backed with several undercoatings.

* Iso-Glas is Dorsett's exclusive laminate of fiber glass and isophthalic resin.



GEL-COATS become an integral part of the fiber glass and resin shell that is built up in successive layers as shown in the left and right photographs above. The boat is built in two main sections: an integral hull and a separate deck.



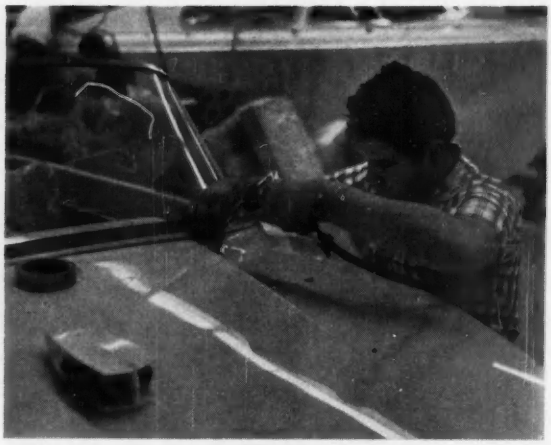
TO FORM the double bottom, a mahogany framework is made, utilizing special Cal-Nailer air-driven nailing machines. The bottom is positioned in the hull, left, and covered with resin and fiber glass layers to secure and protect it, right.

TO HULL are added other members (transom, seat blocks, etc.) of marine plywood; these are resin-coated to seal them from the elements. Left picture shows an air gun blowing away bits of sawdust before resin painting. Next step is removing shell from mold, right, with wedges and a jet of water injected between mold and shell. Note mirror finish. Hull is then put on dolly.

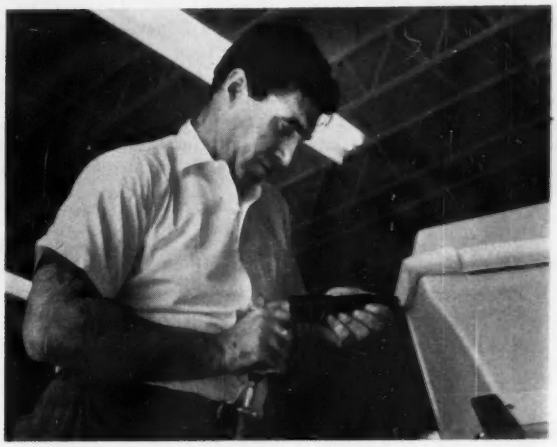
HARDWARE for the steering cables is now installed on the underside of the deck before it is joined to hull. Trim pads are also put on hull, left, with an air-powered stapler. When such tasks are complete, the deck is set on the hull and the two members are stapled with an air-powered fastener, right. Cement placed in the joint earlier also helps lock the two together.

TRIMMING the hull deck joint with an Ingersoll-Rand air saw, left, is the next step. The light tool does the job quickly but provides the necessary close control of the cut. Short radius corners are pared of waste with an air-powered router, right.

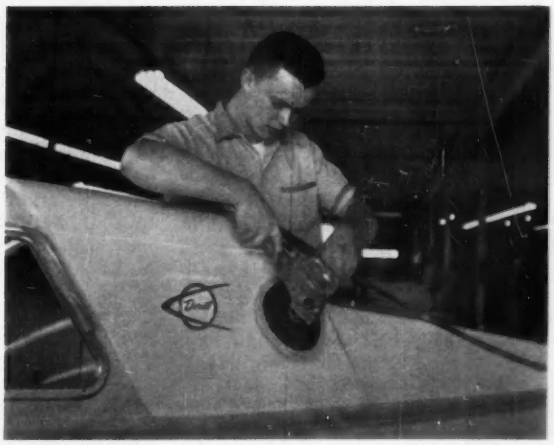
ROUGH-CUT edges are smoothed by an I-R series 1F grinder, left. Edge is beveled and a plastic rubber trim slipped over it. If damaged in use, trim can be easily replaced. Finish work, right, includes mounting windshield with a series 00 screwdriver.

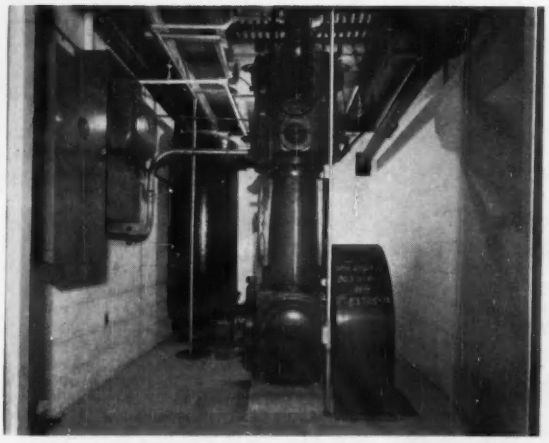


FINISHING continues with the addition of such hardware as a running light on the bow, left, and a cleat on the stern, shown in the right picture. Air-powered air drills and screwdrivers make these detailed operations move swiftly.



NEARLY finished boat is pictured in the left view as three men add fixtures. The final step before shipping is to wax and buff the smooth Iso-Glas surface, right. For this an air-driven series 1FL tool is used; automotive wax has been applied.





AIR for the Dorsett marine tools is provided by the I-R compressor at left, a 75-hp double-acting ESV. Its receiver is at left rear. A wide angle lens has distorted this view somewhat while showing the machine in its space-saving location. At right is a Dorsett boat in its natural habitat. This particular craft is the 18-foot Sea Hawk which is propelled by a water jet.

IF YOU were a motorist travelling on a highway downstream from Lucky Peak Dam near Boise, Idaho, you would have been annoyed with wind-carried spray misting your windshield and interfering with your driving. The spray came from six flip buckets which curved upward at their downstream ends on radii averaging 75 degrees and which were used to release water from the flood control and irrigation storage dam. They have not only bothered motorists, but have troubled the U. S. Army Corps of Engineers ever since Lucky Peak was completed late in 1953.

DAM MODIFICATION

Robert J. Brown, Jr.

IF YOU are a motorist travelling on the highway downstream from Lucky Peak Dam, you won't be annoyed with water spray on your windshield anymore. General Construction, Denver, Colo., recently completed an unusual modification project on the manifold discharge structure for the Corps of Engineers. The project was undertaken when the Corps decided to eliminate three of the six flip buckets—a job requiring the removal of sections more than 24 feet long and ranging from 8 to 12 feet high at the downstream ends. The important thing, according to project superintendent Paul Judd, was that "Line drilling allowed us to do the job in about half the time it would have taken the same number of men with paving breakers."

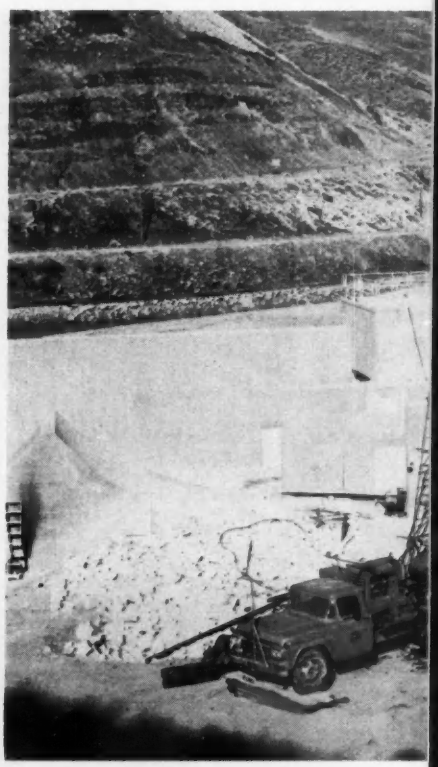
As a start on the task, General Construction drilled a total of 186 horizontal holes along the base of each section on its downstream face. The holes, each 24 feet deep, were bored with an X71 Ingersoll-Rand FM3 wagon drill. Three-inch carbide-insert bits were used with 8-foot sectional steel connected with Type 2 couplings.

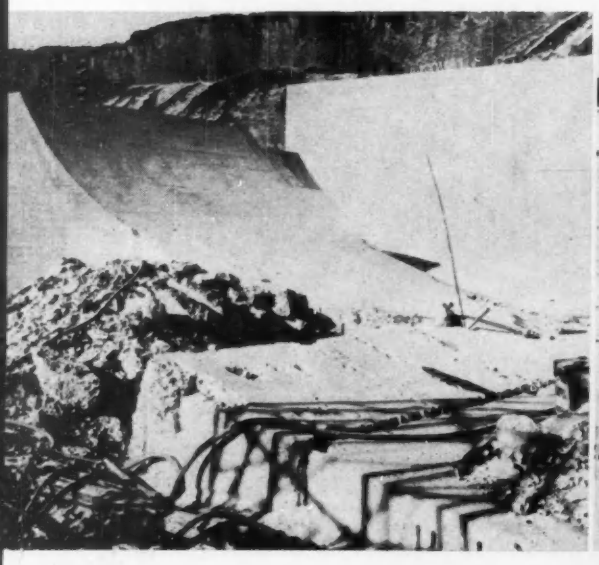
Shifting to the top of the buckets, the contractor used vertical line drilling to divide each of the sections into six portions. Three rows of holes were drilled laterally and a single row longitudinally. The drillers first bored $3^1/_2$-inch holes on 5-inch centers for each row, then doubled back to break out the webs with $2^1/_2$-inch holes between the larger ones. A total of about 8000 lineal feet was drilled in this manner. The holes averaged 6 feet in depth. The line drilling was done with an Ingersoll-Rand DA35 drifter drill using Carset (carbide-insert) bits.

To complete the bucket removal, General Construction brought in a Delmag D12 diesel pile hammer mounted on a Bucyrus-Erie 22B truck crane. The hammer was used to pound 6- and 8-foot-long wedges vertically into the rows of holes bored in the tops of the buckets. This cracked the concrete to the row of horizontal holes at the base of the sections. Chunks of concrete ranging to 14 tons were broken off by the wedges and lifted out of the way by the truck crane.

The contract also included extending four concrete piers separating the three demolished flip buckets. The piers originally extended only a short distance, making it difficult for the dam's operators to perform maintenance on the manifold structure gates when water was being released during flood-control drawdowns and the irrigation season.

Prefabricated steel training walls were used to extend the piers. Three of these unusual hollow structures were 28 feet long, 8 feet high and 1 foot thick, while the fourth was a shorter unit used to extend a pier to the curving upper surface





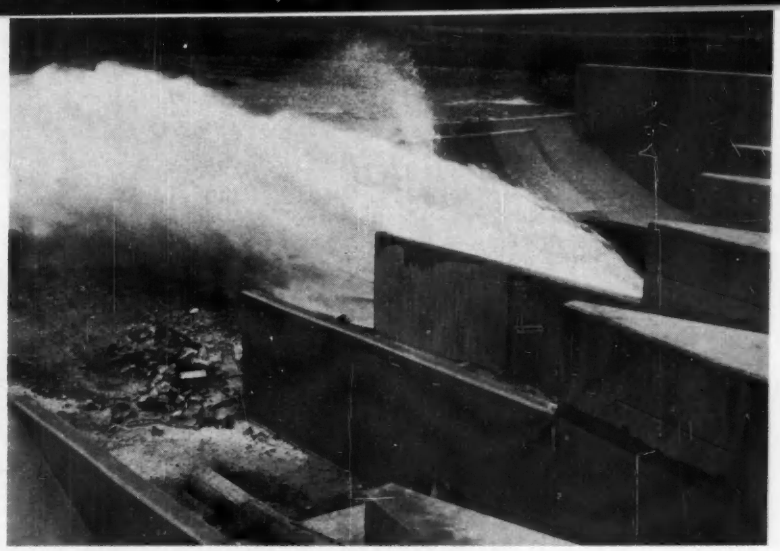
PATTERN/HOLES Close-up pattern of holes drilled by General Construction Company to divide sections of flip buckets into six portions. Several sections of the bucket already have been removed by wedges driven vertically into the rows of holes, cracking concrete. Contractor drilled about 8000 lineal feet of vertical holes, averaging 6 feet in depth. At left, driller points to holes bored in existing pier to carve cut for separate steel plate that ties new wall to pier. Holes also were used to hold plates in position by means of hook anchors.

of one of the buckets that was left intact.

The three full-sized extensions were of similar construction, consisting of a core of seven 10-inch-wide flanged I beams. A $^{3}/_{4}$-inch-thick sheet of extra-hard U. S. Steel T-1 plate steel was plug-welded to each side of the core. T-1 steel was used to face the walls because of the wearing effect of the jet-like discharges of water.

A 25-ton truck crane installed the 10-ton prefabricated walls as complete units. Eight-foot-long extensions, or legs, of the I beams were fitted into 16-inch-diameter holes and grouted in place to anchor the walls to the floor of the manifold structure. The anchor holes, each 8 feet deep, were bored by truck-mounted drills using the Calyx method.

To prevent leakage under the walls, cavities were chipped in the concrete of the manifold structure's floor and filled with epoxy resin-base grout as a seal.



The grout hardens to a strength of 7000 pounds per square inch in 24 hours.

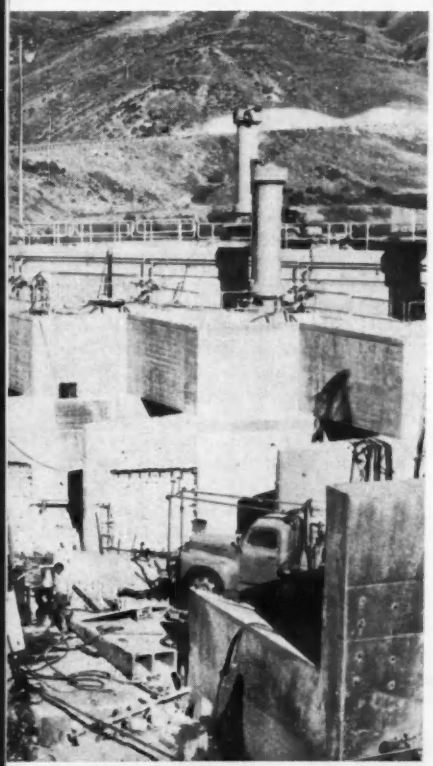
Between the new walls and the existing piers, General Construction installed separate steel plates as connecting links. The plates were set into cuts carved in the piers in two operations.

An Ingersoll-Rand Jackleg drill, equipped with a $1^{5}/_{8}$-inch carbide-insert bit, was used to sink holes on 6-inch centers in the piers. A 60-pound paving breaker with a "concrete buster" head then was used to chip out the cuts, each of which was 12 feet long, 8 feet high and 1-foot deep.

Twenty-two hook anchors of No. 8 reinforcing steel were used to hold each of the separate steel plates in position in the cuts. Eleven of the anchors were welded to the plate and the other eleven were welded into drilled holes in the piers. After the plates were in place they were welded at one end to the new walls and, at the other end, to the existing steel liner plate on the piers.

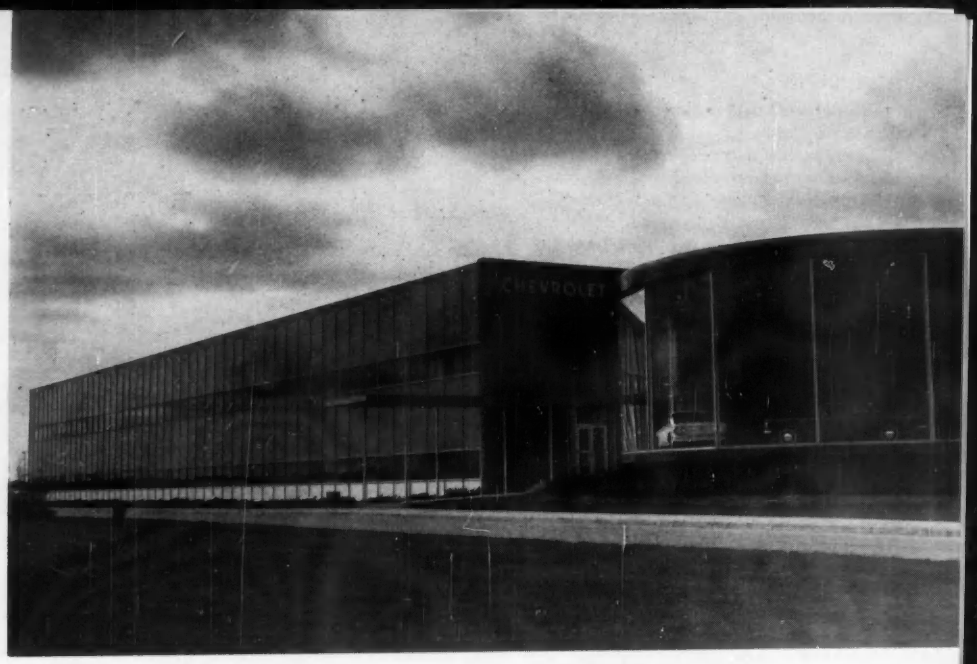
The final step in the wall installation was taken by filling each of the new hollow training walls with Prepakt concrete. First water was pumped into each of the walls to saturate the aggregate and provide a "head" to force the grout into every void. Grout was also pumped into the spaces behind each of the separate steel plates. The grouting operation was performed under a subcontract by Selby Drilling Company. Supplying air for the job was an Ingersoll-Rand 600-cfm Gyro-Flo compressor.

Above is a view of the modified discharge, showing water spewing from one of the discharge compartments. Note that the flip buckets have been removed and the new prefabricated steel training walls are in place.



EARLY STAGE/GROUTING Above, over-all view of Lucky Peak discharge structure shows early stages of modification project. Truck-mounted drills were boring holes by Calyx method for use in anchoring new prefabricated steel training walls. Two of flip buckets that were left intact are seen at left. At right, Selby Drilling Company crew mixes grout used to fill new hollow steel walls installed after buckets were removed. Air for grouting operations was supplied by the Ingersoll-Rand 600-cfm Gyro-Flo compressor in the background.

notes about pneumatics in a compact car's construction



Corvair Air

WHEN it first came out a couple of years ago Chevrolet's Corvair wowed the automotive public with its radical design. Rightly so, for it was a new car from top to bottom, with its horizontally-opposed 6-cylinder engine, its unit frame and body, and its trim high-hipline styling. Though hesitant at first the buying public eventually showed its approval of the first production air-cooled American auto and its popularity soared, paced by the sporty Monza models.

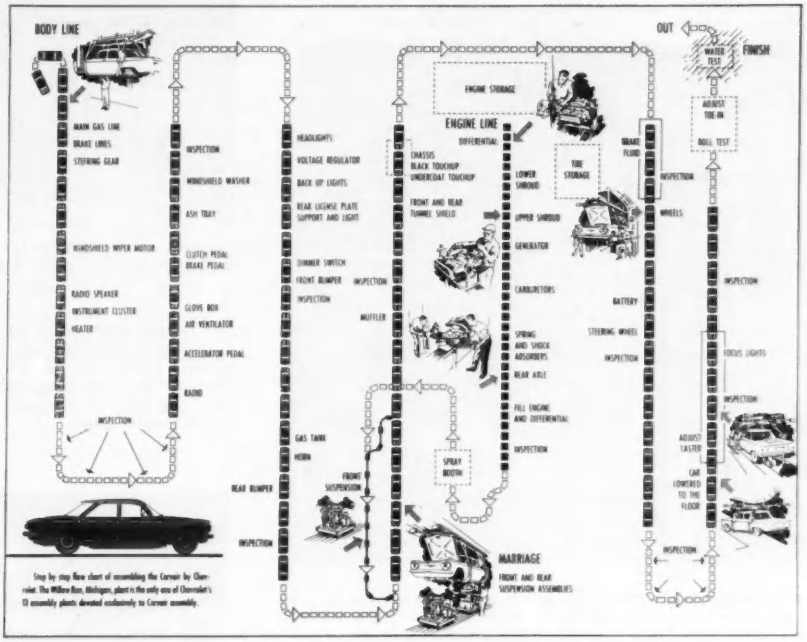
The way the Corvair was handled on the assembly line at the Willow Run, Mich., plant was different too. For the most part the components are added from the bottom instead of being dropped in from above. During assembly the car is suspended at one of two levels from overhead hangers and not until just before roll testing does the car feel the pavement.

Despite these innovations, compressed air, as in most automobile assembly plants, is a main driving force in fashioning a car out of stockpiles of components. *Compressed Air Magazine* recently made an extensive tour of the Willow Run plant and watched as the well-proportioned compacts were put together. (Four other Chevrolet plants build Corvair models but this plant is the only one that builds the compact exclusively.) By far the greatest number of air tools present were conventional hand-held units such as Impactools and air-driven screwdrivers, but at several locations ingenious uses of air and tools were applied.

Though simple in idea and appearance, one such device took part of a process engineer's time for 2 months before he solved the problem to his satisfaction. This proves the adage that a tool which looks starkly simple and works faultlessly probably required a good deal of cerebration. It had to do with tire inflation—or rather deflation. The Corvair's rear tires are run at about 28 psig because the engine is in the rear and needs a healthy amount of pressure to support it. The front tires, however, are run at only 14 psig because they support less weight.

It was not deemed practical to have two inflation units—one for each pressure—so initially the tires are all blown up to 28 pounds. The problem was how to quickly drop the front tire pres-

IMPACTOOLS These air-powered wrenches are shown in the two pictures at left early in the body assembly. The first worker anchors shielding and the other tightens down a gas tank strap. In the right photo the Impactool helps mount a motor.



Step by step flow chart of assembling the Corvair by Chevrolet. The Willow Run, Michigan, plant is the only one of Chevrolet's 12 assembly plants devoted exclusively to Corvair assembly.

sure to the desired 14 pounds. After the 2 months of mulling and experimenting, the process engineer solved the problem. He simply filled a small tank with air at a pressure of 14 psig. As the front wheels are moved down from above to be put on the car, they are hooked into a regulator and air line leading to the tank. The tire pressure falls until it equalizes with the pressure in the tank, the excess air passing out through a valve.

The machine that initially inflates the tires to 28 pounds is interesting too. It places the tire on the rim at the same time as air is first put in. The well-soaped tire is held horizontally and as the rim is being inserted, compressed air whooshes into the tire with a sudden rush. Air does not enter through the valve stem but passes between the rim and the tire. In about a second the wheel goes from a limp member to a hard, fully inflated unit ready for the road.

When the wheels are ready to be put on the car, another air-powered tool is used. This unit is an Ingersoll-Rand multiple-spindle assembly machine that fits simultaneously over all four wheel studs. The operator presses a trigger and all nuts are run down in an instant to the correct torque.

One unique air-powered device was built by Corvair engineers from hand-held air tool components. It automatically adjusts parking brake cables to the correct tension; the operator doesn't have to test it. Two scissor-like arms hold the cable. Between the two is a hook through which the cable passes. When the correct tension is reached, the cable being tightened pulls on the center loop hard enough to close a valve. This valve shuts off the air.

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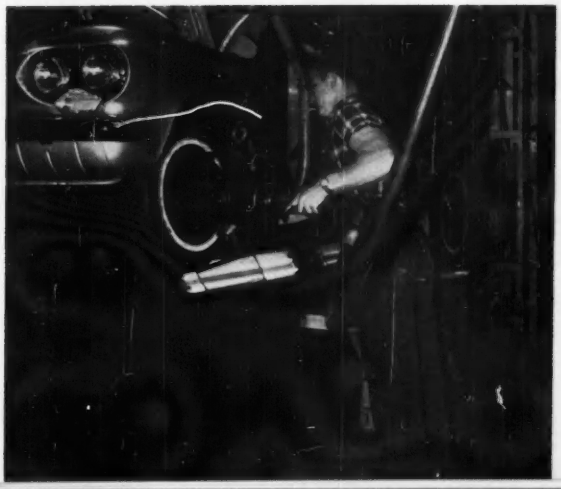
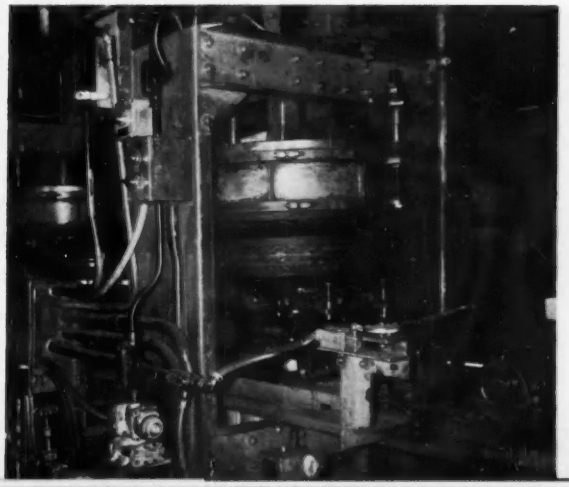
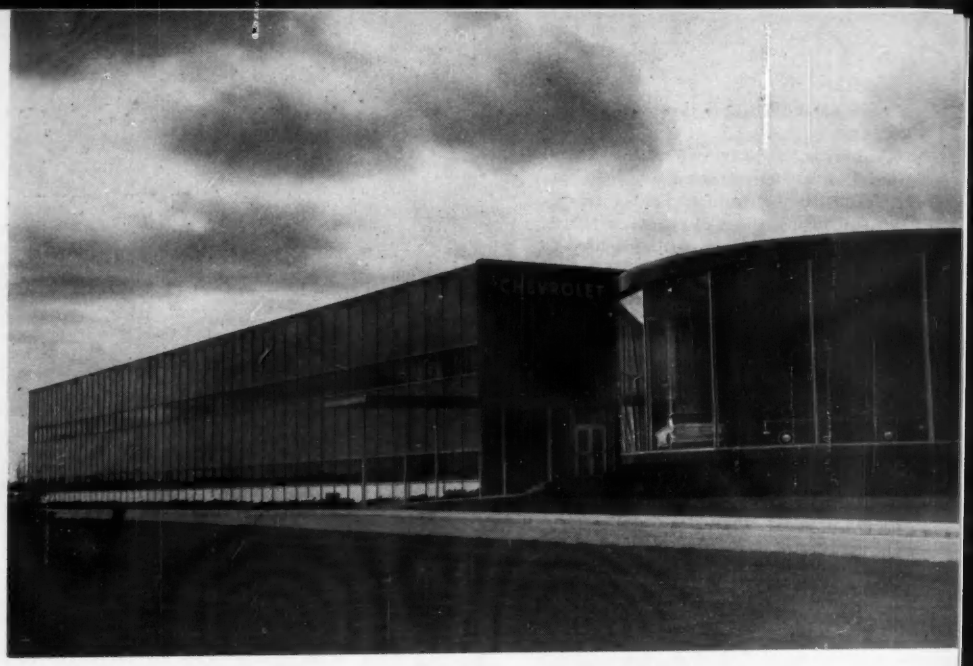




notes about pneumatics in a compact car's construction



Corvair Air

WHEN it first came out a couple of years ago Chevrolet's Corvair wowed the automotive public with its radical design. Rightly so, for it was a new car from top to bottom, with its horizontally-opposed 6-cylinder engine, its unit frame and body, and its trim high-hipline styling. Though hesitant at first the buying public eventually showed its approval of the first production air-cooled American auto and its popularity soared, paced by the sporty Monza models.

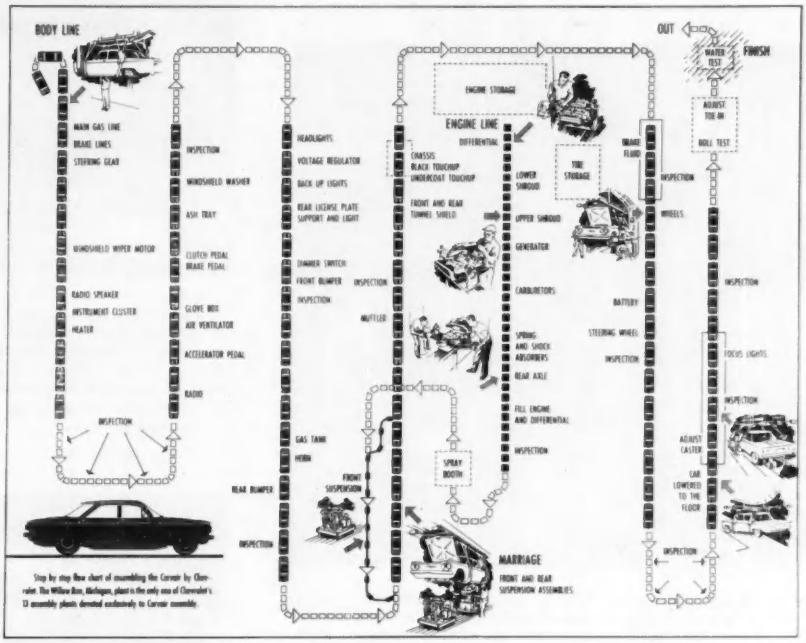
The way the Corvair was handled on the assembly line at the Willow Run, Mich., plant was different too. For the most part the components are added from the bottom instead of being dropped in from above. During assembly the car is suspended at one of two levels from overhead hangers and not until just before roll testing does the car feel the pavement.

Despite these innovations, compressed air, as in most automobile assembly plants, is a main driving force in fashioning a car out of stockpiles of components. *Compressed Air Magazine* recently made an extensive tour of the Willow Run plant and watched as the well-proportioned compacts were put together. (Four other Chevrolet plants build Corvair models but this plant is the only one that builds the compact exclusively.) By far the greatest number of air tools present were conventional hand-held units such as Impactools and air-driven screwdrivers, but at several locations ingenious uses of air and tools were applied.

Though simple in idea and appearance, one such device took part of a process engineer's time for 2 months before he solved the problem to his satisfaction. This proves the adage that a tool which looks starkly simple and works faultlessly probably required a good deal of cerebration. It had to do with tire inflation—or rather deflation. The Corvair's rear tires are run at about 28 psig because the engine is in the rear and needs a healthy amount of pressure to support it. The front tires, however, are run at only 14 psig because they support less weight.

It was not deemed practical to have two inflation units—one for each pressure—so initially the tires are all blown up to 28 pounds. The problem was how to quickly drop the front tire pres-

IMPACTOOLS These air-powered wrenches are shown in the two pictures at left early in the body assembly. The first worker anchors shielding and the other tightens down a gas tank strap. In the right photo the Impactool helps mount a motor.



Step by step flow chart of assembling the Corvair by Chevrolet. The Willow Run, Michigan, plant is the only one of Chevrolet's 13 assembly plants devoted exclusively to Corvair assembly.

sure to the desired 14 pounds. After the 2 months of mulling and experimenting, the process engineer solved the problem. He simply filled a small tank with air at a pressure of 14 psig. As the front wheels are moved down from above to be put on the car, they are hooked into a regulator and air line leading to the tank. The tire pressure falls until it equalizes with the pressure in the tank, the excess air passing out through a valve.

The machine that initially inflates the tires to 28 pounds is interesting too. It places the tire on the rim at the same time as air is first put in. The well-soaped tire is held horizontally and as the rim is being inserted, compressed air whooshes into the tire with a sudden rush. Air does not enter through the valve stem but passes between the rim and the tire. In about a second the wheel goes from a limp member to a hard, fully inflated unit ready for the road.

When the wheels are ready to be put on the car, another air-powered tool is used. This unit is an Ingersoll-Rand multiple-spindle assembly machine that fits simultaneously over all four wheel studs. The operator presses a trigger and all nuts are run down in an instant to the correct torque.

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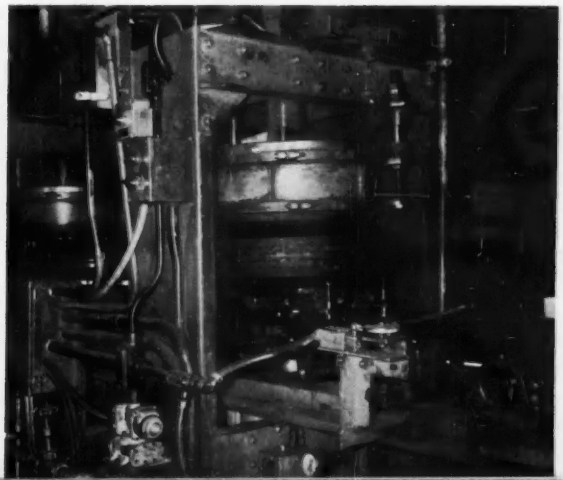
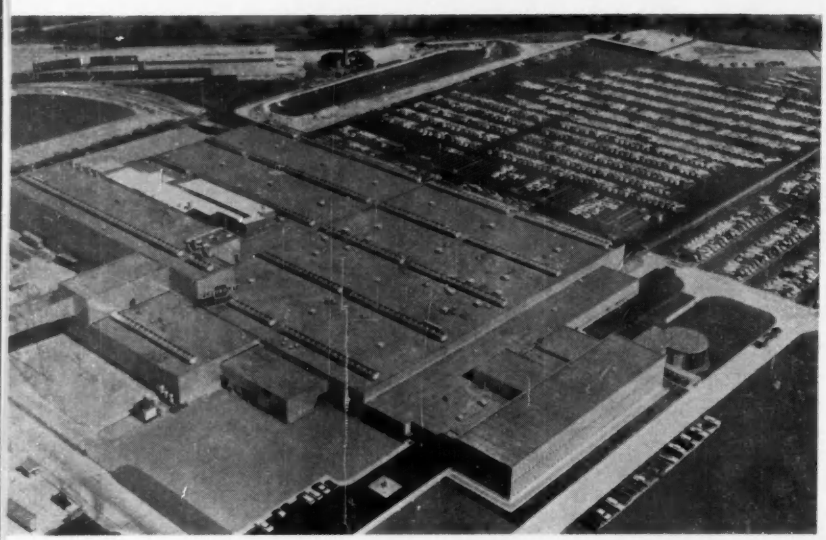
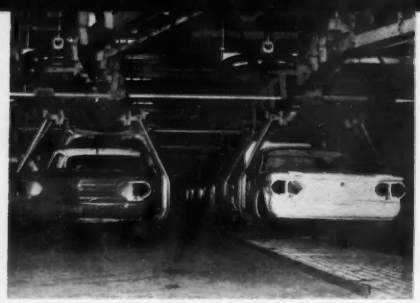


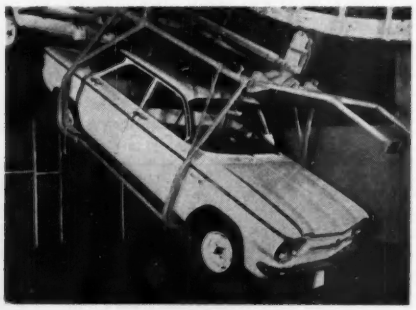


WILLOW RUN PLANT Above is an aerial view of the new Willow Run facility that turns out Corvairs. Construction is currently extending the right section of this plant. Below is another view inside the automobile assembly plant.



Through the Line . . . . . .

Car bodies, above, wait on hangers before moving down to assembly line, as shown in first shot below. Other pictures illustrate "marriage" of body to the two suspensions; nearly-completed car's first ride on its own wheels; and, finally, the finished Corvair.



Flame Plus Volts

A new patented process provides an economical high heat source by combining chemical and electrical energy. The Combex-ADL burner, as it is called, has been under development for 2 years by Arthur D. Little, Inc., Cambridge, Mass. It is an invention of Bela Karlovitz of Combustion & Explosives Research, Inc., Pittsburgh, Pa. The burner is able to supply heat at temperatures from 3000° to 6000° F. It raises the energy output from an ordinary combustion by a fuel oxidant mixture by actually superimposing electrical energy on the flame. A low-current, high voltage, a-c discharge is used. The burner is applicable, ADL reports, to impingement heating for cutting, welding, spalling, scarfing and drilling.

★ ★ ★

Hydrofoil Ship And Namesake

The first oceangoing hydrofoil ship will be named the HS (hydrofoil ship) *Denison*, in honor of Charles R. Denison, the man who initiated the project for the U.S. Department of Commerce. Denison was appointed in August 1957 as the first coordinator of research for the Federal Maritime Board and Maritime Administration. He served as advisor in the planning and execution of the research and development program undertaken for the improvement of the U. S. merchant marine. One of the projects sponsored by Denison was an experimental oceangoing hydrofoil craft. He knew of the successful use of hydrofoils in sheltered water areas and felt the idea might be applied to allow greater speeds for conventional ships. Feasibility and design studies in hydrofoils were made by Dynamic Developments, Inc., an affiliate of Grumman Aircraft Engineering Corporation. The Maritime Administration then awarded this company a contract to design and build an 80-ton, 60-knot oceangoing hydrofoil craft. The government is paying about $1,500,000 of the estimated $5,000,000 cost of the ship; associated firms will bear part of the production costs. Designed to determine the practicality of large hydrofoils in the 500–1000-ton range for high speed ocean transportation, the vessel is now under construction. It is expected to be launched this summer and will be delivered almost immediately.

The ship's namesake was a Saranac, N. Y., native and served as a civil engineer with the Army Engineers, emerging from World War II as a colonel. He joined the U. S. Maritime Commission's Division of Research in 1946 and later took a post with the Massachusetts Institute of Technology. Denison subsequently returned to the Federal Maritime Board/Maritime Administration and served in various research and planning capacities. He died in October 1959, just as the contract for the construction of the hydrofoil craft was being prepared. Mr. Denison has been described as being "a scientist with humor and imagination. His dedicated efforts to improve the operating efficiency of U. S. merchant ships may have far reaching effects that will help to keep our fleet a leader among the world's merchant marines."

"You'll find a few extra banana peels in your pay envelope this week."

this & that

Air Ions Affect Comfort

Studies by a New York University scientist indicate that the ions in the air influence human comfort and they are perhaps as important as temperature and humidity. In general, negative ions seem to be helpful whereas positive ions reduce comfort. Conventional heating or cooling systems in large buildings pipe warmed or chilled air through ducts. Negative ions move faster than positive ones so they collect on the wall of the pipes and are discharged. Air entering a room, therefore, is positively charged and this builds up such a condition in the room.

To test the phenomenon volunteers were exposed to streams of 20,000 ions in each cubic centimeter (in an air conditioned room there was found to be a normal supply of only about 190 positive and 150 negative ions per cubic centimeter). Psychological examinations revealed that the presence of small negative ions increased work capacity. They appeared to be beneficial to the neural system by increasing the flicker-fusion threshold; positive ions did the opposite. A flicker-fusion test checks a person's ability to detect the difference between a steady light and one flickering at high speeds.

One of the ramifications of the studies, still in the early stages, is that air pollution usually creates positive ionization. Also, it appears obvious that what with pollution, air conditioning and hot air heating, changes in the air's ionic range mean man is not working under the best of conditions.

★ ★ ★

Most Efficient "Vessel"

The U. S. Navy has plunked down $200,000 in research funds to learn more about the porpoise. The reason is that the seagoing mammal, also called the dolphin, can do just about everything better than submarines and ships. Take porpoise sonar. It is so accurate that a blindfolded dolphin can navigate around pipes and bars being moved in the water. It can tell when a plate of glass separates a fish from it, and when the path lies unobstructed. When a person slaps the water with his hand, the animal can swim to the spot from 60 to 80 feet away, missing by only a few inches. Research has already shown that the playful sea creatures communicate with about 20 distinct sounds, from gurgles to squeaks. They usually react to sounds up to 80,000 cycles per second, though man's upper limit of hearing is about 20,000 cps. One trained female porpoise at the Naval Ordnance Test Station, China Lake, Calif., has produced sounds varying from a bass-like 750 cps to 300,000 cps, far, far beyond human audibility.

Then there's the phenomenon of movement in water. The porpoise swims with an up-and-down motion in-

stead of a side-to-side fish-like action. Ship captains have reportedly clocked specimens moving at 25–30 knots; the China Lake dolphin mentioned above has cruised at a 16-knot top speed. From a given unit of muscle, the dolphin gets about ten times as much horsepower as does a man or dog. Whether lolling along or swimming in a hurry the dolphin leaves very little wake. This indicates there is almost no drag—another thing the Navy would be interested in learning more about.

One of the air-breathing animal's most interesting abilities is to avoid what divers used to call the bends, the painful and crippling formation of nitrogen bubbles in the blood when moving quickly from a high to a low pressure. The porpoise can stay submerged in 1000 feet of water for a long time, then shoot to the surface without harm. Some biologists are beginning to place the dolphin above the chimpanzee in intelligence. One reason is that the sea mammal can learn to shut off a switch to avoid an electric shock in only about 20 trials, while a chimp may take hundreds of jolts before learning to trip the switch.

★ ★ ★

Inter Planetary "Tires"

A doughnut-shaped inflatable fabric ring to stabilize and cushion the landing of space vehicles on the moon or planets has been proposed by Goodyear Aircraft Corporation. A full-scale model has been technically and analytically studied. Called a pneumatic decelerator, it would be deflated and packed around the sides of a space vehicle. As the craft slowed for landing, the inflatable coated fabric tubing would be positioned below the payload and braced. Then each of its segmented compartments would be inflated individually to soften the landing. Upon impact, there would be a quick-release device to partially deflate the "tire" and thereby absorb the vehicle's main weight. Thus the space ship would settle softly on the surface, cushioned by the partially inflated compartments of the decelerator, without bouncing or upsetting. A series of drops duplicating lunar rebound and stability conditions proved it would bring a heavy load to rest safely, even on hard, rocky or sloped surfaces. Similar GAC decelerators have been generally used as energy absorption units for equipment descending by parachute and for recovery of missiles during test firings.

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TVA Facts Of Life

Here are a few recent financial and operational facts about the TVA. Net income from TVA's power operations during calender year 1960 exceeded $52 million, up $2.6 million over 1959, according to the agency's report for the second quarter of its fiscal year 1961. The total of net power proceeds for the year was nearly $102 million. TVA has paid a dividend of $20.7 million to the U. S. Treasury on the appropriations invested in its power system. This is half the total payable during fiscal year 1961. New records of loads and generation were established during the quarter in question. A peak hourly demand of 10,322,000 kw occurred in January, exceeding December's peak by 681,000 kw. TVA's sales to industry rose a little during the first 6 months of the fiscal year and sales to municipal and co-operative distributors were 9 percent higher than in the corresponding quarter a year ago. In December TVA placed an order with General Electric for two 800,000-kw turbogenerators which will be the largest ever manufactured. Construction progressed on 3,000,000 kw of other new generating capacity, most of it in five record-size steam generating units to be in service by the end of 1963. When the first of the 800,000-kw units is on line the installed capacity of the TVA power system will exceed 15 million kw.

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A Boat On Your Back

For the man who wants a light, compact boat, the Amerimex Corporation's Airboat seems to be the perfect answer. Although 12½ feet long, it weighs only 23 pounds. It can be transported easily by car, bus, plane, or it can just be carried on foot. Yet there is nothing to assemble. The Airboat is inflated and deflated in minutes at the point of use. Not only is the vessel rugged, it is reported to be unsinkable. Capsizing is unheard of. Constructed of laminated rubber fabric, the craft can be used with an outboard motor, sail or paddle making it ideal for fishing and hunting, or as a lifeboat or dinghy. A large-volume foot pump, two sets of back and seat cushions, two wooden back rests, full-length floor boards, spare parts kit and a combination hand or shoulder carry duffle bag are included with each Airboat. The complete boat rolls into a 10 x 19-inch cylinder.

★ ★ ★

Accident Prone Facts

If you are an accident prone person, chances are you tend to be impulsive, rebellious toward authority and want to punish yourself. Further, you give little thought to planning and anticipating future pleasures. Your rebellion is probably carried over from childhood occurrences, and the hostility you feel even goes against safety rules. These findings were reported at a recent meeting of the Building Research Institute by a member of the Pennsylvania Department of Health, Harrisburg, Pa. The need for self-punishment, the psychiatric studies show, probably eases guilt resulting from hostile feelings. The study also indicates that an accident prone person remains so for only a portion of his lifetime and that the "unlucky" group is ever changing.

★ ★ ★

Air's Legal Force

Air can exert other types of force besides pressure. The U. S. government, for instance, recently seized 33 cases of Swiss cheese. The government charged that the cheese was not truly Swiss cheese and that its air holes, alas, were faked. As a matter of interest, real Swiss forms its "eyes" as a result of bacteria cultures that are introduced into the product. Although cheeses are sold throughout the world under about 500 names, there are probably only about 18 different separate varieties. Differences in the same cheese may be only in shape or size, or in flavor and texture due to different methods of cooking the curd or curing. Swiss cheese is also known as Emmenthaler after the valley in Switzerland where it originated in the 1400's.

editorial

Growth of Cryogenic Gases

WILLIAM B. Nicholson, president of Linde Company, Division of Union Carbide, estimates that total domestic sales of the industry hit $518 million in 1960. And, he stated, "From all indications, we expect this market to reach the $650 million-per-year level by 1964."

For an industry that in 1950 shipped about $142.5 million worth of product according to government statistics, this represents a growth factor considerably in advance of the rest of domestic industry.

For the most part, the great expansion in the production of industrial cryogenic gases has been due to considerable strides in the technology of producing them. Availability at a cost conducive to large-scale use has undoubtedly given the major impetus to many developmental schemes.

Essentially the strides that have been made in the production of those gases derived by liquefying air have been in the areas of equipment size and over-all as well as thermal efficiency: there are few significant differences between processes of today and those of a quarter century ago.

At the heart of every air fractionation plant stands a compressor—the fundamental starting point of the process. Steps forward in this type of equipment have been great. Not too many years ago, a single compressor pumped air into the system, another handled nitrogen counterflows, others took care of other gases. Now much bigger machines (but occupying considerably less floor space and requiring less power than an equivalent number of the older type) handle input air in one set of cylinders, and a variety of other gases in other cylinders, all on the same frame and driven by a single driver. Indeed, some success has been experienced with such compressors having expander (refrigeration) cylinders so that the energy of expanding gases can be put directly back into the system.

Another step of considerable importance is the use of centrifugal machines for supplying air. Units with built-in intercooling between stages have been successfully applied in several cases and have reduced to a great degree the floor space required, besides furnishing a largely oil-free and pulsationless supply of air.

Such things as advanced liquid gas pumps, cryogenic storage vessels, high-speed expanders and improved insulations all have contributed to the great expansion of capacity and lowering of costs.

Perhaps the most important single new user of oxygen in recent years has been the steel industry. During 1960, ten on-site plants were built for steel mill supply, boosting total industry capacity by 2835 tons per day over the 1959 total. From an estimated 100 cubic feet of oxygen per ingot ton of steel produced in 1950, use of the gas grew to about 350 cubic feet per ton last year. Customers buying oxygen from Linde are a little ahead of industry averages and use 550 cubic feet per ton with estimates of 750 cubic feet to be used for each ton of steel made by the end of the year.

The next major addition to present steel mill oxygen demands—scarfing, open hearth lancing, decarburization, ladle cleaning—will probably be in blast furnaces. The economics are quite simple: use of oxygen can delay major capital outlays for new furnaces by several years by pushing production upward. Three producers are now experimenting with the process and four or five more will probably be doing so by the end of 1962. By 1963, the process should be commercially acceptable. Plans are afoot to use oxygen in smelting and refining of nonferrous metals.

Chemical oxygen is that used by the chemical industry as a replacement for air in oxidation processes. The difference in oxidizing ability as compared to air with about 20 percent O_2 content is obvious. The prediction is that by 1970 chemical uses of oxygen will take about 70 percent of all capacity. Right now the figure is about 40 to 45 percent.

Medical uses of oxygen form a small but important part of capacity. With new treatments and with hospital-wide distribution systems, it is anticipated that demands for medical grade oxygen will rise from three to five times in the next 5 years.

Nitrogen is an important coproduct of oxygen —a high purity stream can be derived from an oxygen producing plant at little extra cost. It has found wide use as the inert gas atmosphere for bright annealing. (Although nitrogen is economically produced by other types of generators, its availability from on-site O_2 plants provides an attractive alternate source.) Chemicals industries are also investigating the nitrogen blanketing of fine chemicals during handling or working to protect them from oxidation or contamination.

Liquid nitrogen refrigeration to protect perishables during shipment is also finding favor. Devices that use liquid nitrogen have a considerable weight advantage over other means. Liquid neon refrigeration has also come into the picture —it provides nearly three times as much refrigeration value as an equal volume of the other cryogenic fluids.

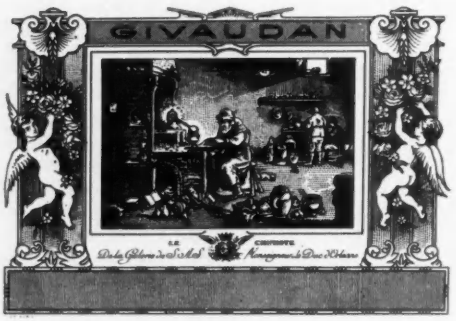
Argon is another coproduct of air fractionation plants that at the present time might almost be said to be in oversupply. One use is inert-gas shielded welding. Blanketing of reactive metals during refining and working has also been tried.

Hydrogen, of course, is the glamour gas of the space age. As a fuel it has possibilities almost beyond belief—even in an age of atomic power. New methods of producing liquefied streams of exceptionally high purity have been evolved, as well as equipment and techniques for handling the liquid.

All of these gases ase undergoing considerable research in the field of cryogenics as strictly defined. The wide range of extreme low temperature devices that are now little more than laboratory curiosities could one day require significant amounts of liquefied gases. But no matter what the end use may be, all of the industrial cryogenic gases start their useful lives in a compressor.

FRAGRANCE

S. M. Parkhill



PERFUMERY is far more than the aura of enchantment that a woman creates when she applies an alluring perfume or the fragrance that is added to the many cosmetics and toiletries offered by the multimillion dollar toilet goods industry in America. Perfumery is the artistry of the perfumer, the science of the chemist and the technology of the engineer. And, it is big business. Although yearly sales of perfume chemicals, often called aromatics, amount to less than one hundred million dollars, industries dependent upon them annually run the commerce into billions.

Originally perfume was not for scenting the body, but for masking all kinds of unpleasant odors. Musk, now a common fixative on the perfumer's palette, was used with gums of frankincense and myrrh to disguise the smell of burning flesh at sacrificial rites. Other scents were used to cover disagreeable odors in living quarters. Perfume bellows that were favored by Cardinal Richelieu, for example, were popular in many French apartments.

Today aromatics continue to mask and neutralize, but more important, pleasant scent is widely used as a marketing incentive. Cosmetics would lack their allure without a fragrance. Soaps are scented and even such common household products as cleansing powders have a pleasant odor. Plastics and rubber products, paints, glues and a multitude of other specialties would have intolerable odors were it not for the addition of perfume chemicals.

Less thought of are such applications as the addition of aromatic chemicals at the base of waste gas stacks to cover the offensive odor of the waste. Lubricating oil for high-speed cutting machines is usually perfumed; and irritation caused by burning diesel fuel can be reduced by adding aromatics to it.

At the other end of the olfactory scale are the unpleasant aromatics added deliberately to otherwise odorless materials. Refrigeration gases are generally without smell. Breaks in refrigerant lines can be detected with added sulphurous mercaptans. These chemicals are also added to odorless fuel gas to warn of leaks.

Perfume chemicals have many other roles. They are limited only by man's imagination. The great aromatic chemical houses are devoted to stimulating that imagination.

The Perfumer's Palette

The odorous compounds of the pervasive world of perfumery were, until the mid-1800's, blends of fragrances found in nature—essential oils and resinoids laboriously extracted from plants and flowers, and fixatives processed from animal products. The production of these rich ingredients could not keep pace with demand. For example, 1 pound of essence of violet, beloved by ancient Greeks and later in France by Marie Antoinette, requires 33,000 pounds of leaves and a great deal of patience, since for every pound of leaves, it is estimated 2000 flowers must be picked. Costs climbed sharply. Prices fluctuated greatly.

In the 1830's a revolution began that has kept the products of the perfume chemists and the artistry of the perfumers within reasonable cost limits. Man found he could duplicate nature. Oil of

mirbane was undoubtedly the first of the new synthetics. It was simply the reaction product of nitric acid and benzene. Today, is no longer used; indeed, it is shunned by the perfumers.

Not until 1868 was the first significant contribution made. Sir William Perkin, famed for his purple coal tar dye, (see *Compressed Air Magazine*, April 1957), produced coumarin. Its fragrance was that of hay or the sweet-scented European herb, woodruff. Since then many interesting and important new compounds have been synthesized. They fall into three classifications.

The first step in copying nature is to isolate the substance of greatest value in an essential oil. (These oils are complex chemical mixtures that give each plant its distinctive odor. They are constantly being produced as a part of the plant's metabolism, and vaporize when exposed to air. Although thousands have been isolated, only about 10 percent are presently of value.) Distillation, chemical reagents, special solvents, chilling and crystallization: all play a part in isolating them.

After isolation comes purification. Eventually the number of atoms of carbon, hydrogen, oxygen, etc., that are present in the molecule is determined. A chemical formula, including the precise arrangement of the atoms is next established. It is not enough to know that, for example, the molecular formula for vanillin, the most important substance in the oil of the vanilla bean is $C_8H_8O_3$. How these nineteen atoms are arranged is critical if the odor is to be duplicated. Such synthetics, known in nature, are recreated by man at a cost far below that of essential oils obtained from nature.

The next group consists of those which are still unknown in nature. Synthetic musks such as the nitro-musks, macrocyclic musks and Versalide are good examples. (Musk is a fixitive that enriches and rounds out an aromatic compound. It adds a distinctive note that becomes an integral part of a perfume's harmony.)

Natural musk is obtained from the male musk deer. This little, agile creature lives high in the mountains of Tibet. Not only are the animals difficult to reach, they are elusive. However, they do have an Achilles' heel; musk deer love music. Hunters who manage the mountain climb play flutes and the curious deer come to the kill. Although their valuable preputial follicles can be obtained without slaughter, many have been killed and the species is threatened with extinction.

The dried glands, or pods, were once wrapped in tissue and packed in silk-covered caddies for export to China and European markets. The odor was expensive then, and it is more costly now. Even without the current embargo prohibiting musk imports into the U. S., price alone creates a demand for musk replacements. The importance of these synthetics is further strengthened by the fact that they are purer and of more uniform quality than the oft-adulterated musk pods. The creative perfumer can depend on them.

The third type of synthetics on the compounder's shelf are those obtained directly or indirectly from natural oils. One is Linalool, described in the definitive *Givaudan Index* as having a "light and sweet odor, with a citrus suggestion." Violet-smelling ionone is another. Its discovery reads like an old "Passing Parade" film script.

Following a somewhat unwarranted assumption, Ferdinand Tiemann and his co-workers attempted to isolate a violet-smelling ingredient from oil of orris. They succeeded in isolating an oily cyclic ketone which they named irone. It is the odoriferous principal of orris root and has the violet note. They then analyzed the molecule and published what they thought was its formula. It proved incorrect, and the proposed structural arrangement was consequently the wrong one.

From this wrong formula and incorrect arrangement, Tiemann and an assistant, one Paul Kruger, began to build a new chemical compound which they hoped would have the violet odor of orris root. Using citral, the aldehyde in lemongrass oil, an attempt was made to condense it with acetone, splitting off water and leaving the irone. Naturally no irone was to be found in the condensation. Legend in the chemical coterie has it that the disgusted Kruger was washing out the beaker with a strong mineral acid when to his amazement the desired floral fragrance arose. The new compound was called ionone. Tiemann and Kruger were awarded a patent for it in 1893.

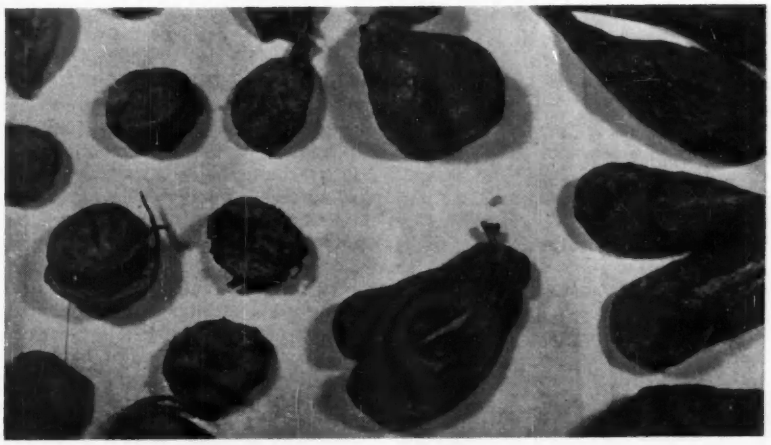
Coming of Age

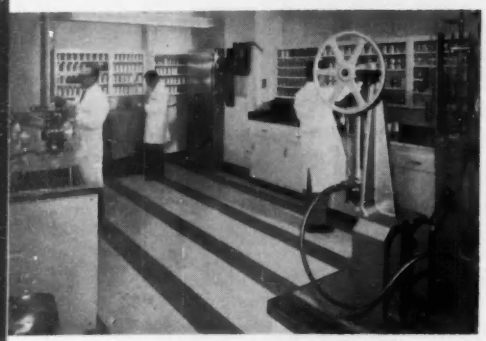
Ionone could be produced inexpensively compared to the essence of violet described earlier. And again, the synthetic was of a more stable and standard quality than the natural product. Despite these obvious advantages, synthetics met with cold reception, if not hot opposition, from users and makers of the essential oils.

Nevertheless there were a few who thought there was a brilliant future if synthetic aromatics could be produced on a larger scale, with stable quality and at a low cost. One was Leon Givaudan. Two years after the Tiemann-Kruger patent, he opened a small laboratory in Geneva. Its production of fine chemicals was on a limited scale with most of the output being used by a pharmaceutical plant in Lyons, France, which was owned by his brother Xavier.

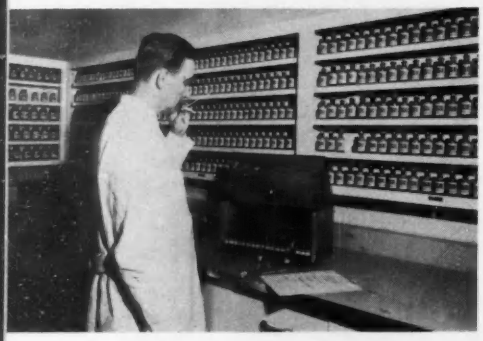
Foreseeing the potential of synthetics, Leon started a factory at Vernier, at the base of the Saleve Mountain 5 miles downstream on the Rhone from Geneva. The project had the financial backing of Xavier. From this beginning in 1898,

FOR FIXITIVES Musk, obtained from the musk deer above, when diluted becomes a pleasant ambrosia. The pods are shown at the left below. Similarly castor from Canadian Beaver, right in the lower picture, is nauseating in full strength but on dilution, quite pleasing.





NEW YORK, N. Y. Two laboratories in Givaudan's New York office are shown. Above is the aerosol lab, first set up when aerosol packaging was introduced, and later considerably expanded. In center background is an oven for accelerated shelf-life testing. Below is a chemist in one of the perfume laboratories.



the House of Givaudan has grown into a complex world-wide organization of associated companies. At its conception it was one of the very few perfume chemical manufacturers in Central Europe. Today it stands in the first rank of aromatic chemicals houses. It has been said that "both as a producer of the largest number of commercially used chemicals for perfumery and as maker of the largest quantities, the Givaudan plants have taken world leadership. Many aromatics in wide use were first synthesized by Givaudan chemists; others were first made in a purified form, or at commercially feasible prices. . ." It might be added that the company's work in flavors is becoming equally well regarded. And in pharmaceuticals, Givaudan can claim such discoveries as G-11*—better known as Hexachlorophene USP—a leading antibacterial substance. It was evolved in Delawanna, N. J., laboratories of Dr. William S. Gump.

Xavier, now more than 94 years old, is still very active as Chairman of the Board. "That young fellow," as he is referred to by a colleague, who is himself 2 or 3 years older, still goes to the office every morning.

* Registered Trade-Mark of Sindor Corporation

The Givaudan organization has nine sales offices in the U. S. and Canada. Associate companies and office headquarters are located in Vernier-Geneva, Switzerland; Lyons, France; Whyteleafe-London, England; Delawanna, N. J., U. S. A.; and Sao Paulo, Brazil. Another plant is under construction in Barcelona, Spain and one is planned for Buenos Aires, Argentina.

Returning to the acceptance of synthetics, ionone eventually overcame public resistance. The revolution that had begun feebly with oil of mirbane was complete. Since the *fin de siecle*, dozens of major developments have been achieved annually, as Leon Givaudan had predicted. It has been estimated that in the last half century, some 20,000 aromatics have been developed. Of these, the average perfumer works with about 3000. It is not surprising that the perfume chemical houses have taken over the roles of research and development from the now "specialized" perfume manufacturers.

Givaudan was a pioneer in commercial production and promotion of ionones, as well as synthetic musks, vanillin, and other aromatics. World War I brought a new demand for such synthetics and benzylic alcohol, benzyl benzoate and eugenol for airplane varnishes. It also demanded manpower; Leon Givaudan was drafted. Because of his experience in aromatics, he was recalled from service along with a former technical director at Vernier, C. L. Barillet, to set up another plant at Lyons to meet wartime demands.

After the war, synthetic aromatics were finding a comfortable place in the hypercritical French perfume market, and the Lyons facility expanded rapidly. The Paris office was established to keep in touch with these demanding users. Together with the Geneva-Vernier facilities, it became an installation of great industrial and commercial importance. From Givaudan comes a steady stream of new aromatics and compounds, skills and emperical knowledge that have helped Givaudan's world leadership and assured the success of each new branch of the company.

Compounds and Specialties

The three types of synthetic aromatics mentioned so far give the perfumer a triple advantage over his pre-nineteenth century counterparts: they (1) permit shading that is unobtainable with natural products alone; (2) produce effects unobtainable using only natural oils and resinoids; and (3) control quality and cost of the final compound. Of course, it must be remembered that essential oils are still used, though to a lesser degree than a century and a half ago. They give nuances of depth and harmony to a finished product. Dr. Ernest Guenther, at a lecture at the Ohio State University College of Pharmacy last year, remarked "connoisseurs of odors and flavors can detect minute gaps between synthetics and essences. Even mechanical extraction does not seem to yield the same product. Experts may insist, for example, on lemon oils that are laboriously rubbed from the fruit by Sicilian peasants." The position of natural oil and resinoids must never be underestimated on the creative perfumer's palette.

There is yet another ingredient available to the perfumer—specialties. At the Givaudan-Delawanna headquarters in New York City and at the Delawanna, N. J., plant, perfumers are creators. In perfume laboratories, artists analyze, study, select with discrimination and compound the thousands of aromatics available. They are constantly seeking potential aromatic values in new chemicals and creating new blends for the perfumer to use. These blends are the compounds and specialties. They have character and vitality that cannot be achieved in essential oils, animal products or even the synthetics. As a perfume base, they give a fragrance one of its basic elements—intrinsic character.

Some specialties have become classics: Givaudan's famed Lilas Fleurs VII, Jasmonis, and Folioris 53, to name but three. Sophora and Melittis are among a plethora of aromatics that depart from nature's fragrances. Their names invoke as many olfactory memories to perfumers as such words as rose, jasmine and lemon do to the layman. Many are created in the stills, flasks and distillation columns in the laboratories of the researchers in Delawanna. The creators in these bottle-filled rooms are constantly searching for a new fragrances, new aromatic chemicals that can be isolated, new combinations for specialties that can go into major production schedules.

Development of specialties—and aromatic chemicals in general—is one public responsiblity of the great perfume houses. They have large staffs of perfumers, technicians and chemists capable of tackling the big job. They also have the urge to create, for it seems axiomatic that the larger the company, the greater its inventiveness. In Givaudan's New York laboratories, for example, all known aromatic chemicals are available to specialists. And new ones are being added regularly. Each creator has his own laboratory which is as spotless as any hospital lab. Each room is air conditioned, the air being constantly changed and filtered to assure its being as odorfree as possible. Temperature is closely controlled. As a further precaution, air in each laboratory is slightly pressurized. No odors from hallways or other labs can enter when the doors are opened.

Amid arrays of bottles, both exotic and mundane, and the latest equipment, as hypersensitive electronic balances ca-

DELAWANNA, N. J. **This aerial view shows the Delawanna facilities of Givaudan. From this triangular plot comes a multitude of aromatic and flavor chemicals. The main administration building, with compounding rooms and analytical laboratories is at left. Manufacturing facilities surround it.**

pable of measurements accurate to within 1/30 gram, the white-gowned perfumer-artist creates compounds and specialties.

Research

Hundreds of chemicals are synthesized each year by research chemists in a continuing search for new aromatics to enlarge the perfumer's palette. A select few that meet his exacting requirements are approved for marketing. Givaudan has been foremost in offering new aromatics to the fragrance industry. Some of these products—Moskeen, Musk Tibetine, Versalide, and Lilial—have been widely used in the industry for years in this country and abroad. Sandela, Nerone and Folrosia are new additions laboriously selected from the hundreds made in the Givaudan research laboratories in recent years. All aromatic chemicals are checked to see if they have a potential in the soap industry. Standard cakes scented with the various perfume chemicals are made in a miniature soap "factory" just as they would be commercially. Each bar is carefully coded and stored in a box lined to stimulate wrappers. If discoloration develops, the chemical is deemed unsuitable for the soap market and generally reaches the end of its brief "commercial" existance. Other properties that have come to light during the investigation are precisely indexed for further applications.

Chemicals are also tested in aerosol laboratories. Many aromatic blends react peculiarly when emitted as a mist from a pressurized can because of differing rates of varporization, molecular weights, consistencies, solubility and the like. Even differing pressures can cause changes in a basic aroma. Every aromatic compound slated for aesosol use must be tested, for each creates its own problems.

The aerosol labs at Givaudan-Delawanna were established in the early 1940's when "bombs" were first being developed. All types and mixtures of commercial and experimental propellants are available. Shelf-life is stimulated in ovens, and a water bath is used to check possible leakage. Cans, valves, and seals of every description are on hand for the researchers. Corrosion, clogging and problems unique to aerosols are checked along with product stability and compatibility.

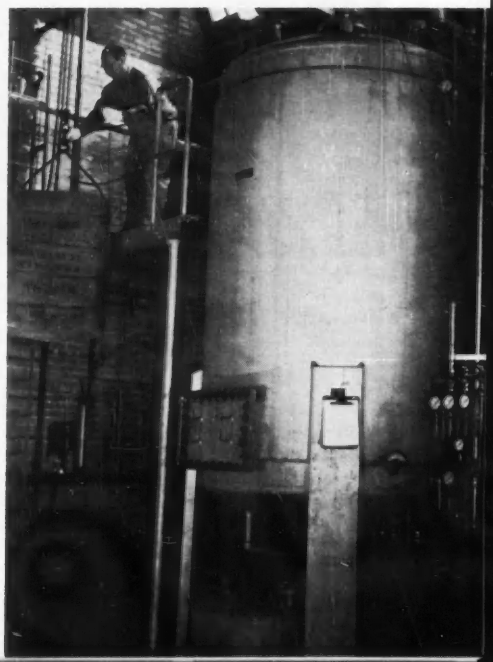
Largest of the New York City labs is devoted to cosmetic chemistry. Here perfume compounds are put in lipsticks, aftershave lotions, powders, oils and talcs. The reaction is checked on a continuous shelf-life testing program, noting such things as irritation, discoloration, toxicity, coverage, palatability and stability. Thousands of test products are being studied at a time.

One of the chief chemists said, "We are sure of our product, but we have to guess how the customer is going to use it." The buyer might unwittingly destroy the basic aroma by mixing it improperly in his own cosmetic formulas. This chemist was expressing the company's slogan: "Fragrance is your business . . . and ours."

Delawanna

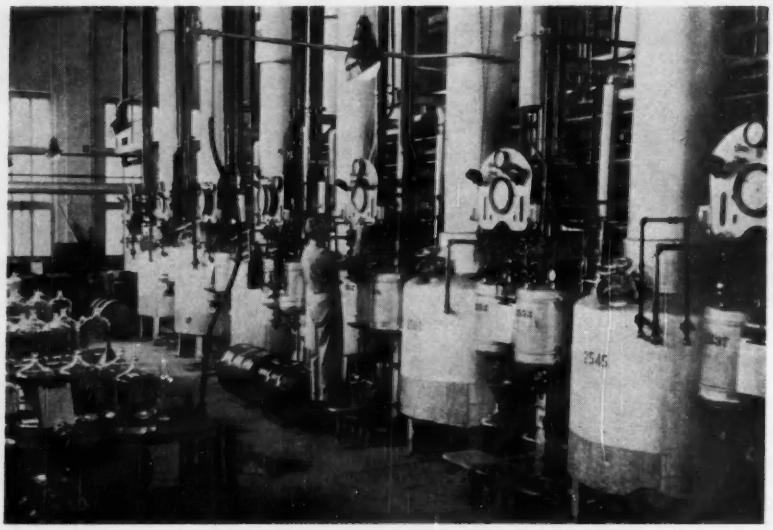
Supporting each other are Givaudan's New York office and the large plant at Delawanna. It is the largest of the perfume chemical plants in the U. S., and there can be seen the perfumer and chemist at work.

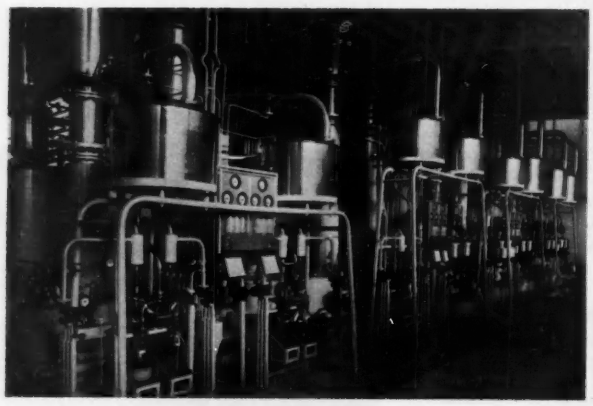
The value of a perfume exists because of the compounder's skill in selecting the correct aromatics, judging their nuances, and blending them in proper proportions. How well the chemist does his job in producing aromatics is gauged specifi-

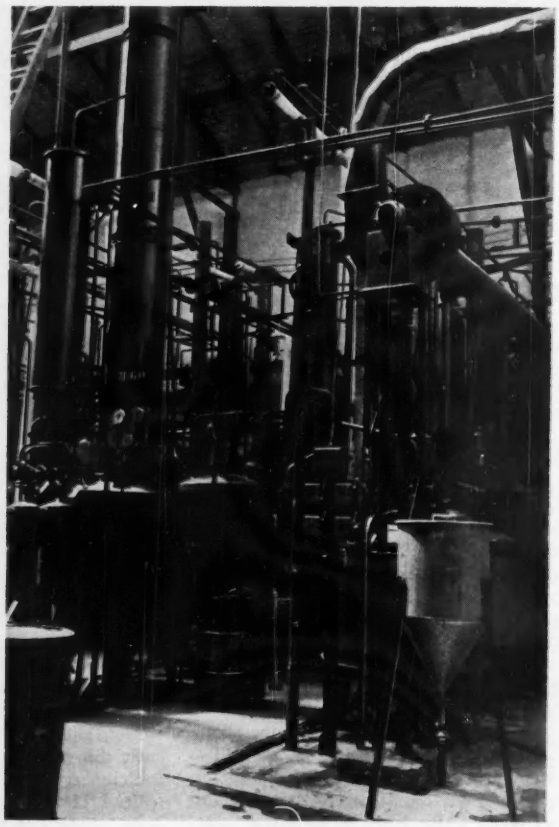


CHARGING **Many pounds of raw materials must be charged into stills to produce a few ounces of essential oil. Shown in the picture at the right is a large extractor used in the extraction of oakmoss. The air hoist is used to reduce possible hazardous conditions.**

DISTILLATION No matter where the distillation room is located in the vast Givaudan organization, the equipment is often quite similar. At right, a large distillation room at the Givaudan plant in Delawanna, N. J. is shown. Below are modern distillation facilities located in plants at Lyons, France; Sao Paulo, Brazil; and Whyteleafe, Surrey, England. The view from the British plant is part of a 2-story distillation building. The lower floor contains all utilities, including vacuum, compressed air and steam facilities. It is also used for charging and discharging stills, the bodies of which partially penetrate the floor. The upper level which is pictured here contains gleaming stills in a variety of metals.







cally by physical and chemical analysis. Compliance with specifications is demanded, of course, but the final acceptance or rejection of an aromatic compound is dependent on the perfumer's nose. The reputation of a perfume chemical manufacturer rises and falls on both the marriage of tones in the perfumer's laboratory and this olfactory analysis. Givaudan's perfume staffs olfactory control is precise and respected.

As described, the perfumer's palette is composed of synthetic aromatic chemicals which may or may not duplicate nature, essential oils and resinoids derived from plants and flowers, tinctures of animal products, and specialties. No finished compound is composed entirely of any one of these groups of chemicals. Rather, it is a blend of them. It is not uncommon for a perfume to contain as many as 50 different aromatics. And some are made up of more than 300. At Delawanna, the palette is, in reality, shelves of bottled chemicals.

On the second floor of the principal building, the compounding department can make batches from a few grams to 2000 pounds of aromatic chemicals. Higher tonnages are mixed on the ground floor and are often turned out directly into drums, or railroad or truck tankcars for shipment.

The compounders stand at benches. In front of them are rows of bottles of the more commonly used aromatics. To their immediate right are scales. The rest of the room is filled with rows upon rows of shelves containing bottles of chemicals. Most have been made either in the Delawanna factory or in one of the associated companies in the Givaudan complex.

An aromatic chemical developed in the research chemist's labs is first produced in the development department at Delawanna where a process suitable for the plant is worked out. What can be made in a small quantity in a flask will not always be economical to mass produce. Each type of equipment throughout the plant is represented in the development department. After the process has been perfected, it goes to the plant.

Walking through the many buildings one might see an air hoist charging the top of a copper-lined still with raw material. In another, the pungent odor of menthol dominates the senses. Or in still another, at the end of a maze of pipes, stills, fractionators, autoclaves and separators, can be seen a demijohn receiving its precious distillate, drop by drop. The over-all impression is the small number of personnel (for most processes are handled automatically), the variety of odors, and being able to smell, but seldom see, the chemicals.

Compounding

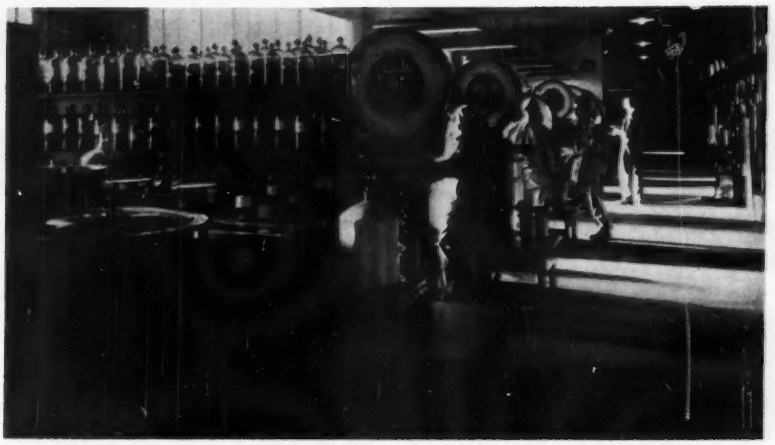
Each compounder works with a formula, scales and a calculating machine by which he can quickly increase the formula from one portion to as many pounds as needed to fill the order. As he mixes, he carefully watches the indicator on the delicate scales, pouring from his left hand the desired aromatic into the mixture—drop by drop. Not until the exact figure desired is registered and the bottle from which he is pouring is uprighted, does he take his eye off the scales. No one speaks to him. No one dashes by, for a simple air movement tilts the balance perceptibly. Accuracy is extremely important.

Compounders can also call on the "rich table." This cart, about 36 inches long, 24 inches wide and 30 inches high, has two shelves. It is kept in a vault when not in use for the contents of the bottles on it represent hundreds of thousands of dollars. Each contains an essential oil derived by time-honored methods—steam distillation, enfleurage and distillation *in vacuo*, maceration, extraction with volatile solvents and expression. The very names on the labels bring to mind the long colorful history of perfumery—jasmin absolute, of nights in oriental gardens; ambergris, of whalers plying the seas; essence of violet, of Marie Antoinette's perfumed soirees.

From the compounding rooms blends are sent to the finishing department for labeling and shipping. Nearly 300 different finished aromatic chemicals are manufactured annually in the Delawanna factory. All are compounded with the same attention and care as the initial mixtures were created in the New York City laboratories.

Quality control is essential and samples are constantly taken to labs where they under go the severest chemical analyses. The factors in quality control are as elusive as the classifications of aromatics themselves. Indeed, V. D. Johnston, director of the analytical laboratory at Delawanna, urges control chemists "not to judge the uniformity of compounded perfume products on the basis of chemical analyses." He goes on to say, "Physical tests, such as color, odor, solubility, specific gravity, refractive index, etc., are the best. For those equipped (as is Givaudan) with infrared, ultraviolet or vapor phase chromatography, these can also be recommended."

Technicians work with delicate equipment in the analytical laboratories constantly checking both the raw materials used in manufacturing and the finished products that will be used by the compounders. The cost of such a control program is justified by the ultimate goal: maintaining Givaudan in its first-rank position. The work of these technicians and analytical chemists, together with the olfactory evaluation of the perfumes, maintains standardized products of high quality, from batch to batch.



COMPOUNDING One of the compounding rooms at Delawanna. In others even more delicate scales are used for smaller lot compounding. In still others, larger ones are employed for tankcar quantities. Note the shelves along the right. These are the bottles that make up the perfumer's palette.

ANALYSIS The analytical laboratory is an important area in modern aromatic and flavor chemical plants. Throughout all stages of production—from raw material to finished product—these chemists keep watchful eyes on manufactured products. The slightest deviation from specification is quickly noted and necessary corrections are made. This is another factor that maintains an aromatic chemist's reputation.

PAINTING STRIPES ON HIGHWAYS

HIGHWAY engineers agree that one of the things that can be done to make highways safer for travelers is to mark zones and lanes clearly. Throughout most of the United States broken lines in your lane indicate that no road obstruction ahead prevents adequate visibility of oncoming traffic. A solid line in the center, or in your lane, indicates that passing isn't safe.

There are, of course, many variations of this. Some highways are triple striped, a solid continuous line appearing between flanking lines that are broken or solid. Sometimes two different colors of paint are used, and often tiny glass beads are put into the paint before it dries to provide greater night visibility. Edges of roads are sometimes marked and almost all multi-lane highways have clearly defined lanes.

There are more than 3,000,000 miles of rural highways in the United States, a total easily equaled by the number of miles of urban roads and streets and private drives. One highway engineer "guesstimates" that of the approximately 6,000,000 miles of highways, about two-thirds to three-fourths is or should be lane-marked. The job is endless—most roads needing at least once-a-year coverage and many, several times that. To do it with a paintbrush and can of paint is patently impossible considering costs and available labor.

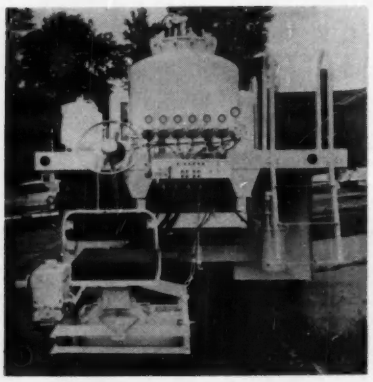
Kelly-Creswell Company, Xenia, Ohio, offers a variety of machines that make the job a great deal simpler and, through automation, considerably more efficient than hand painting. A wide range of sizes is offered so that no matter what job is at hand—from marking industrial and commercial parking lots to an interstate highway—the advantage of mechanization can be gained.

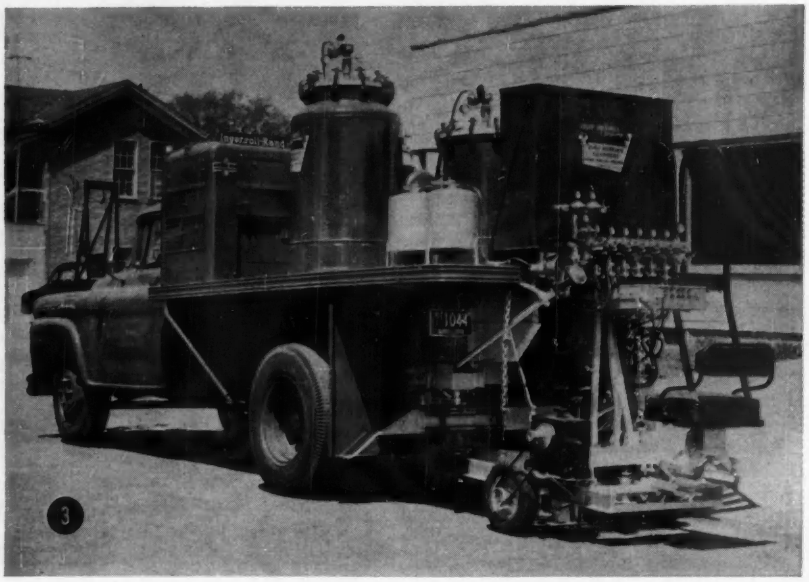
Fundamentally the machines are compressed-air-powered paint spray devices. But to these, Kelly-Creswell has added controls that make them virtually automatic in operation.

In their most complex form, the machines can do a job similar to the hypothetical case following: Assume that a highway requires three stripes, the center one white, and the two flanking pass/no-pass ones yellow. In addition, the yellow lines are to contain glass beads for greater visibility. To meet such specifications, Kelly-Creswell builds to order a machine completely truck-mounted, (or for mounting on the customer's truck) that needs only two men to operate. One drives the truck, the other operates the painting controls and also steers the rear-mounted painting unit so that new lines can be exactly aligned with old ones, thus eliminating a possible source of driver confusion.

On the control system, patterns of spraying can be set up that enable the operator to initiate the spraying of either broken or solid lines on the flank. The automatic section will then take over and the operation will continue until the operator terminates it. There is a manual over-ride on these automatic controls so that the broken line pattern can be advanced or retarded to assure exact registration with previously laid patterns. Once the appropriate control is actuated, glass beads, are dispensed automatically into the paint spray.

Three of the large truck-mounted Kelly-Creswell units are shown here. All are supplied with air at a nominal pressure of 100 psig by an Ingersoll-Rand 125-cfm Gyro-Flo portable compressor mounted on the truck. (Actual pressure delivered to the spray heads is under the control of the operator and depends on paint viscosity, the spray pattern desired, etc.) No. 1 is a single-color, double-line unit supplied to the State of West Virginia. No. 2 is a two-color triple-line unit furnished to Hamilton County, Ohio; and No. 3 is also a two-color, triple-line machine for the State of North Carolina.





Studies Indicate They Are Worthless—

Zoologist Evaluates Anti-Shark Air Curtains

AFTER making a series of scientific tests a zoologist has concluded that the reported effectiveness of repulsing sharks with an air bubble curtain is so much balderdash.

The studies were made at the Lerner Marine Laboratory, Bimini, Bahamas, in March and April by Prof. Perry W. Gilbert, Department of Zoology, Cornell University. In his report Gilbert cited last year's press reports describing how air curtains used at Sea Girt, N. J., and other locations, scared away sharks and how an inventor said 'sharks are so terrified by the shark fence that they will not cross it even to get a juicy steak . . .' (The Sea Girt curtain is shown below during installation.) Zoologist Gilbert also pointed out that the many reports did not mention the species of the sharks repelled, approximate sizes, arrangement of the bubble curtains in the test tank, or the time of day or night when studies were conducted.

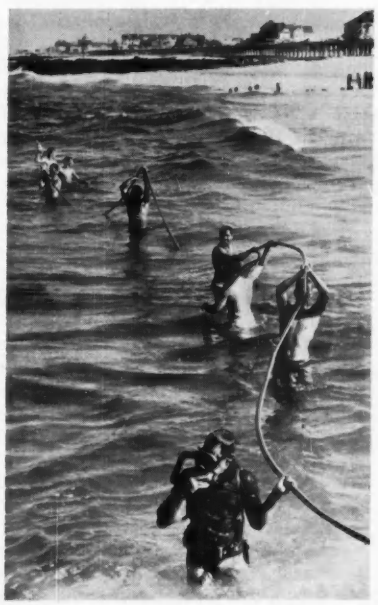
Professor Gilbert clearly saw that a scientific investigation was needed and received funds from the Office of Naval Research to make one. At Bimini he used a pen 80 feet long, 40 feet wide and 7 feet deep. The pen is part of the Bimini Lagoon and is enclosed by a chain-link fence. A 10 foot dock runs along three sides and a catwalk is on the north side. Air was supplied by an electrically driven 2-hp compressor. Air ran to a rubber hose and then to $^{3}/_{4}$-inch galvanized pipe, 19 feet long and drilled with $^{1}/_{16}$-inch holes at 4-inch intervals in a single line. The far end of the pipe was plugged.

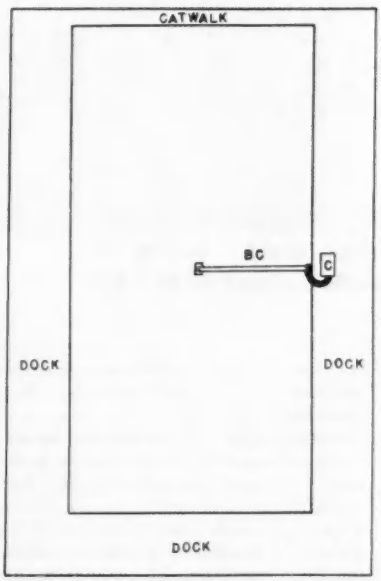
Three tests were made and the first one was quite brief. The single length of bubble curtain (BC) was located as shown in the left line drawing below connected to the compressor (C). Seventeen tiger sharks from $5^{1}/_{2}$ to 13 feet long and weighing 95 to 900 pounds were used. During one 4-minute period two sharks appeared to be turned away by the curtain and ten passed through it seemingly undisturbed. In a second 4-minute trial, one shark appeared to be repulsed by the curtain and six swam through it.

In test two (and three) two lengths of 19-foot perforated pipe were employed, as shown in the other line drawing. They formed sort of a funnel directed toward the upper (north) end of the pen. It was reasoned that if the bubble curtain worked, all thirteen sharks would eventually wander through the quiet hose area (H) of the funnel mouth, gather in the north section and be trapped there. This test lasted 15 minutes and it was soon apparent the curtain didn't function as a funnel or trap. The great majority of sharks uninhibitedly swam back and forth through bubbles.

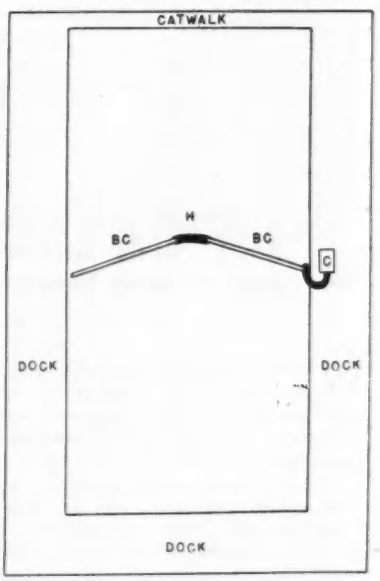
Test three lasted 26 hours. Twelve tiger sharks of a wide range of sizes were used. At first a 10-minute record was kept hourly and then later at longer intervals. During one such 10-minute period, 84 shark passings were made through the curtain. The fewest passes made in one of the 10-minute observations was 51. The air curtain was shut off for two trials; 90 passes were made during the first and 88 during the second.

Professor Gilbert's Shark Research Panel concluded the bubble curtain is ineffective as a barrier. The creatures that were first turned away by the curtain quickly adjusted to its presence. In all the testing only a single shark repeatedly avoided the bubbles.

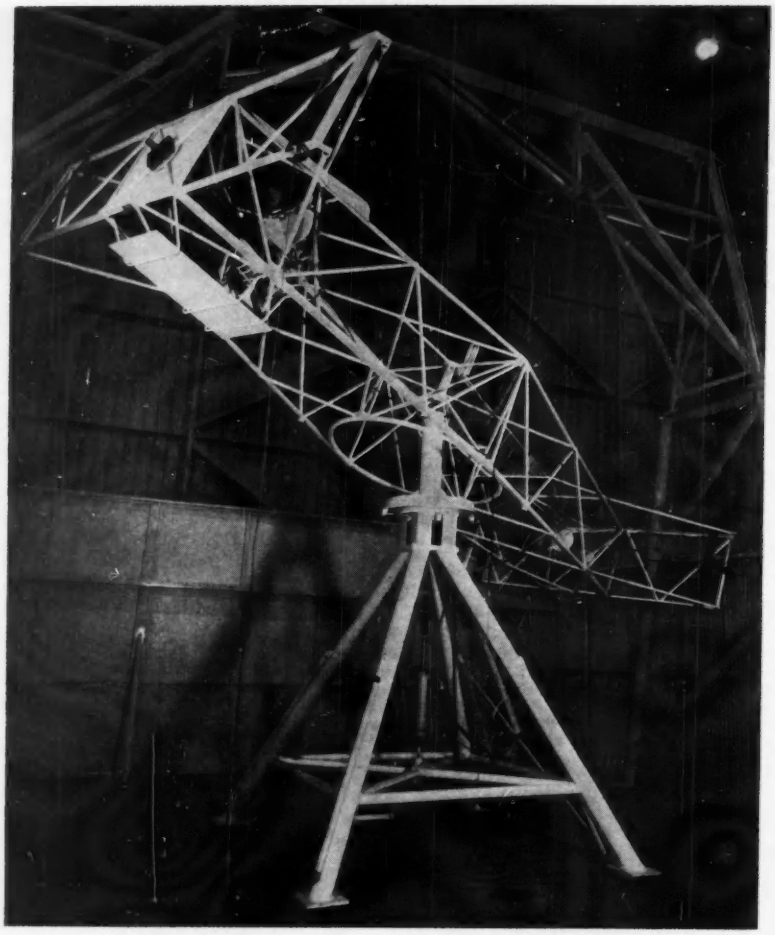




Test 1



Tests 2 and 3



NO CARNIVAL CONTRAPTION

Much of the feel of a space vehicle in flight is experienced during a ride on this Boeing reaction-control simulator. A. M. "Tex" Johnston, Boeing's chief of flight test, puts the test vehicle through its paces. The unit is not a pilot training aid, though. It is a test bed for trying out various methods of controlling the position of a space vehicle in flight.

Reaction-Control Test Vehicle

Compressed air is one of the handmaidens of space travel. Of this there can be no doubt. Boeing Airplane Company presents another aspect of this fact.

WHEN President Kennedy told a joint session of Congress that we must get a man to the moon and back safely, no one laughed or considered impeachment. Imagine the reaction had such a statement been made by his Democratic predecessor, the late President Roosevelt. That we shall live to see this accomplishment is obvious, but for scientists working over the complexities of machines and techniques needed, one fact remains obstinently clear—no man has been there, and it may be a long time before one is.

Consequently these technicians are devising means whereby the feel of flying into outer space can be achieved. Boeing Airplane Company scientists, for example, gain this end with a large research test bed called a reaction-control simulator. Belieing its technical-sounding name, its looks more like a carnival ride than a scientific instrument. Nevertheless, the experts who operate its controls experience many of the conditions they might find in a vehicle moving through outer space. They are able to do so, thanks to an air bearing, compressed gas jets, and pneumatic controls systems.

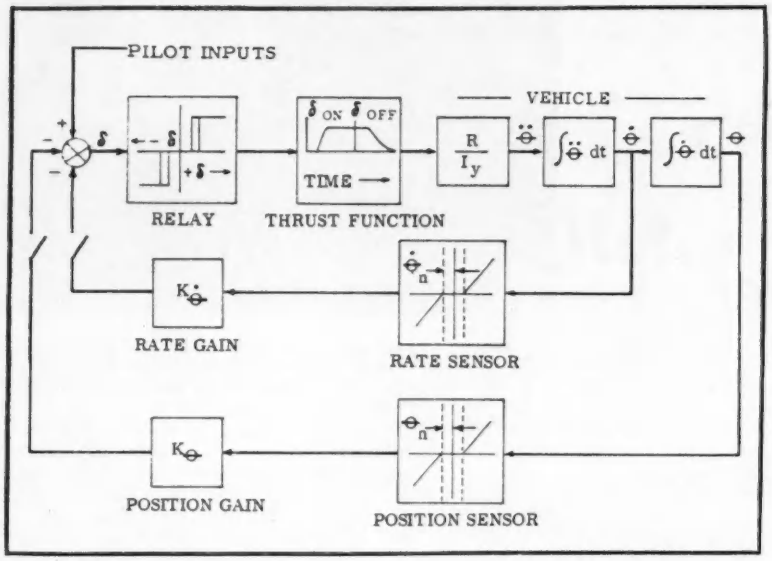
The structural frame of the simulator is capable of supporting enough weight to provide actual vehicle mass moments of inertia. It is large enough to provide the respective control force moment arms so scientists can evaluate actual flight hardware, and it is big enough to take a man aboard so pilot-control capabilities can be studied.

As seen in the photograph, vehicle consists of an H-shaped steel trusswork with variable weights on its extremities. The principal beam is 24 feet long. It is symmetrical about its axis. Two weight-support arms, attached at each end of the beam, provide 6-foot roll moment arms and complete the "H." Pilot-aboard accommodations included within a cockpit on the trusswork are a contour seat with appropriate strapping devices to minimize the pilot's upsetting the delicate balance; a 3-axis, side-arm control stick; and an instrumentation panel. Safety features include a pitch-roll snubber that safely decelerates the vehicle in the event limits of travel are exceeded.

The open-framework simulator is balanced on a near-frictionless spherical air bearing capable of supporting 5000 pounds, which includes 3000 pounds of research equipment. The 5-inch-diameter ball is of nickel alloy steel, plated with 0.001 inch nickel to provide a smooth surface and keep air loss in the bearing at a minimum. It rides in an aluminum socket.

Full rotation freedom is provided: there is complete freedom about the yaw (horizontal rotation) axis and ± 30 degrees of freedom about the pitch and roll axes. Thus applicable space-flight dynamics are simulated. In addition, the test vehicle's motions reflect the near absence of disturbances in space. Gravitational moments are essentially eliminated by locating the vehicle's center of gravity and center of rotation at the same point. The entire device is isolated to prevent disturbances from air currents.

The simulator is so frictionless that a small metal washer placed on one end of the framework will cause the whole ship



Vehicle and Control System Block Diagram

to tip slowly in that direction. Varying the position and size of the metal weights provides the scientists with theoretical vehicles of widely different sizes, shapes and weights.

Since there is no air beyond the earth's surface, ordinary aerodynamic controls, such as rudders, elevators and ailerons, would be useless on a space ship. Forces of some sort will be needed to hold a vehicle at the desired attitude. The simulator will be used to explore many of these control methods.

Blasts of compressed gas from jet reaction controls accelerate the test vehicle slowly into various positions of pitch, roll and yaw. This action can be regulated either by the pilot or through an automatic control system. Incidentally, the simulator was not designed for space-pilot training, but as a test bed with full-scale, space vehicle parameters, to develop methods for controlling a vehicle. However, studies can realistically integrate flight hardware and pilot capabilities.

In addition to systems which use thrust created by blasts of gas, control by flywheels and large gyroscopes will be tried. Forces resulting from accelerating flywheels or the moving of a gyroscope will cause the vehicle to move in the opposite direction.

The system uses compressed air with an on-off servo to regulate vehicle motions. Air at 300-psig pressure is piped aboard the simulator through an overhead line and low-friction swivel joints. Rate and position signals for autopilot operation are available from gyros mounted on an equipment platform. The power and electronics necessary to the control system and displays are ground-based, and are supplied to the simulator together with the air line.

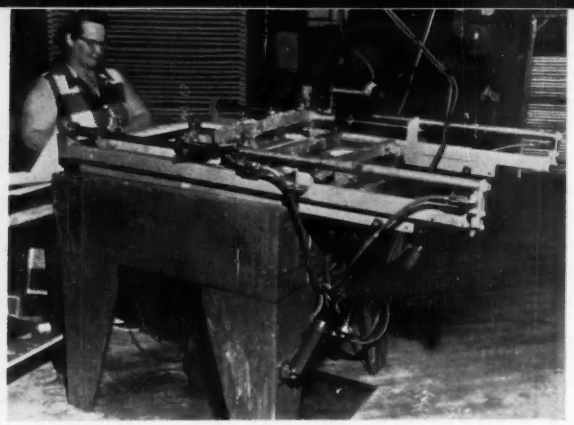
Eight solenoid-controlled, gas-pilot-operated, on-off valves are mounted on the beam and weight support arms on the end of the simulator opposite the pilot seat. They provide the necessary roll, pitch and yaw controls. Four of the eight nozzles are located on the extremities of the weight support arms. Two pitch and two yaw nozzles are placed on the end of the beam.

The control system block diagram is shown in the drawing. Relay hysteresis illustrated in the relay block, was eliminated by using transistor switches. The thrust time function is determined by the required control impulse and the control valve response. The latter can be approximated by a 45-millisecond on-and-off time delay. The dead zone, shown in the transfer functions in the sensor blocks, illustrates another of the many component limitations that had to be considered in the system's design. Switches in the feedback loops enable the pilot to select positions for autopilot, rate autopilot, or direct-valve-control modes of operation independently for each of the vehicle axes. In addition, a complete ground-based, pilot's station is provided, including control stick, displays, and mode switches with vehicle override capabilities. The ground station is to be used primarily for testing control hardware which uses hazardous or toxic fuels.

Tube Polisher

IN 8 seconds, Tube Polisher Model TP2 can clean and polish 4 inches of the exterior end of a boiler tube, removing mill scale, rust and other deposits. This compares to 90 seconds required when the job is done manually with emery cloth. (Such tube cleaning is carried out during the fabrication of heat exchangers and condensers.) Boiler tubes of 1-inch through 2-inch O.D. are accommodated by this handy, automatic tube polisher developed for the marine, petroleum, chemical, power, railroad and metalworking industries. The portable unit is driven by an Ingersoll-Rand OA1M Air Motor which spins a pair of abrasive belt sanders, simultaneously rotating them around the tube end to be polished. The uniform resulting finish presents a machined appearance that is consistent in quality from tube to tube. A cast aluminum guard on the device protects the operator from rotating parts. A 2-page brochure, explaining the time saving benefits and illustrating how the polisher works, is available from the manufacturer. *Hi-Shear Corporation*, 2600 W. Two Hundred Forty-seventh Street, Torrance, Calif.

Silk Screening Graduates To Air Power



PRESS This silk screen press needs only one operator; three were formerly used. Five air cylinders make this possible. The two at bottom raise the screen; the small one at center rotates the squeegee; and the long pair actuate the printing stroke.

COMPRESSED air's use in the silk screen process has increased production, saved labor costs and improved quality of reproduction at Beaverite Products, Inc., Beaver Falls, N. Y.

The company uses silk screening for imprinting loose-leaf binder covers and folders made of artificial leather, plastic, paper or plastic-coated paper. High quality color reproduction is very important.

Silk screening is essentially a stenciling process. Silk or another fabric is stretched on a frame and a design applied. The fabric acts as a stencil when ink is squeegeed on it and the design transferred to whatever is to be decorated. With hand-operated presses formerly used by Beaverite, silk screening was time consuming and comparatively expensive. Quality of reproduction was not consistent. Three employees were needed to run one press: one worked at the feeding station, a second operated the squeegee, and a third handled racking.

To overcome these problems, the company adapted a semiautomatic press using a vacuum bed and an Ingersoll-Rand Type 30 Model 15TE 125–150 psig air compressor. Two standard Bellows air cylinders raise and lower the screen. Another air cylinder rotates the squeegee. Two additional long cylinders actuate the printing stroke.

With the compressed air setup, only one operator is required to run the press, which produces at the same rate as the old unit. Quality has improved. And the new press costs only $2500 compared to $12,000 for a standard mechanical press.

Beaverite has since installed three more presses, all powered by the original Ingersoll-Rand compressor. Three of the presses handle sheets measuring 24×30 inches. The fourth takes sheets 36×48 inches.

The compressed air system is now operating other machines in the plant: two units for electronically sealing ring binder covers, two stamping presses and several staking machines for riveting posts.

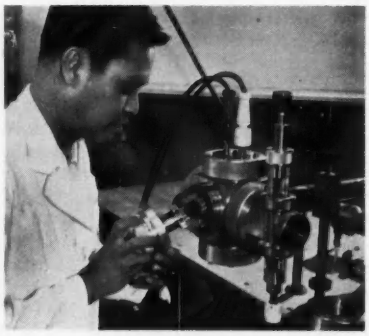
Versatile Vacuum Chamber

A versatile vacuum chamber has been developed by the National Bureau of Standards for preparing the replicate specimens used in electron microscope studies. The chamber has several access ports to which attachments may be fitted for making different types of specimens. Inside is a small volume that may be evacuated to a vacuum of less than 10^{-4} mm Hg in about 7 minutes. Also there is an externally adjustable specimen stage that permits the required angles to be obtained for a series of vacuum evaporations without re-evacuating the chamber.

Two different methods are generally employed to prepare specimens for examination by an electron microscope. In one, tungsten trioxide or metals such as palladium or chromium are "shadow cast" at an inclined angle on a plastic replica of the surface under study. Then carbon or silicon monoxide is vacuum-deposited at normal incidence to give the specimen a high stability in the electron beam. After removal from the chamber, the plastic replica is chemically dissolved to complete the specimen preparation.

In the other method, a dehydrated wetting agent is vaporized directly on the surface to be scrutinized. Either a plain carbon or a preshadowed carbon specimen is then prepared by vacuum evaporation as described above. The vaporized wetting agent aids the stripping of the specimen from the surface substrate.

CHAMBER A technician inserts a rotatable stage. The carbon depositing unit is in port at right and the metal evaporating unit is in top port.



The Bureau's vacuum chamber is a hollow brass cube, $4\frac{1}{2}$ inches on a side. Ports in five sides will take interchangeable attachments. A port machined into the sixth will receive various types of evacuating units. Port windows are made of lucite, and O-rings make enclosures tight.

The port opposite the evacuating system is used to admit a stage component on which several specimens may be mounted. After the chamber has been evacuated, the stage may be manually rotated to any angle in relation to the remaining four ports. One of these acts as an observation window, and two accommodate attachments for shadow casting metals and for depositing carbon. The fourth port is fitted with a wetting agent fixture when a specimen is being prepared directly from the surface under study.

Industrial Notes

VALVES in modern reciprocating compressors—their operation and importance—are the subject of a 44-page booklet entitled *Questions and Answers about Valving, The Heart of the Compressor,* Form 3222 released by Ingersoll-Rand Company. Demands made on valves and their function in a compressor are detailed. Even though subjected to almost every type of destructive force during their operation, valves must hold gas pressure during the compression stroke; then, at the completion of the stroke, snap open quickly to release the compressed gas for efficient compressor operation. The booklet traces the evolution of valving from the mechanically operated intake and heavy poppet discharge valves of the nineteenth century to modern high-speed, air-cushioned valves. A section is devoted to the procedures and equipment used in the manufacture of such modern units as Ingersoll-Rand's Channel Valves. Cartoons and cutaway drawings are used throughout to illustrate valve components and mechanics. Copies of the booklet are available without charge. *Ingersoll-Rand Company,* 11 Broadway, New York 4, N. Y.

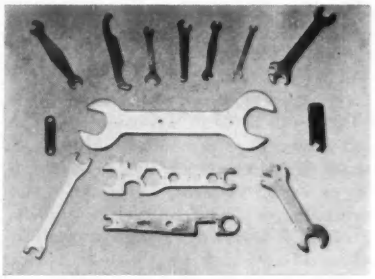
SIGHT-GLASSES are used in those manufacturing processes where chemical reactions of certain expensive and dangerous materials must be studied under high pressures and temperatures. Sight-glass failure has been one of industry's more costly in-plant safety problems. Failures of the unpredictable control cost industry millions of dollars in terms of losses incurred through destruction of equipment, materials, production, and even human life. Now a solution to this problem is offered. The new control is said to virtually eliminate the possibility of lens blowouts or ruptures in sight-glasses, for more than 1000 of the controls have been tested and used for more than 2 years and not a single lens destruction has been reported.

Patented under the names PresSure and Safelite, the device features a unique mounting design for the special glass lens. According to independent laboratory reports, it operates with complete safety in applications ranging from ultra-high vacuum to pressures of 30,000 psig. Furthermore it meets the rigors of pressure, temperature and impact—by some tests, to conditions that are ten times the normal. These experiments included such harsh treatment as sudden and extreme temperature changes, and repeated impacting with steel balls dropped from 8-foot heights. The sight-glass has a minimum safety factor of ten, and is as versatile as it is durable. It can be adapted to present or new equipment, special or standard. A variety of lens arrangements makes it applicable in processes using acids. Colored glass discs shield against intense light and non-browning glass is available for use with radioactive materials. *PresSure Products Company,* P. O. Box 424, Charleston 22, W. Va.

BULLETIN T-191 describes the Siewert Totalizer, an aid to air compressor maintenance. The device, illustrated here, has a five-fold purpose: it measures air consumption, schedules air compressor maintenance, checks compressed air system efficiency, guides the operator in

balancing the load on more than one compressor, and provides data for planning future additional air compressor capacity. Another publication, a booklet which is an outline for an effective air compressor maintenance program, is also available. *Siewert Equipment Company, Inc.,* 175 Akron Street, Rochester 9, N. Y.

UNDER a method of producing special blanking dies to make wrenches, similar hardware, hand tools, etc., in small quantities and at a cost less than forging or casting, Dayton Rogers Manufacturing Company can produce practically any type open-end or box wrench, spanner wrench and other special wrenches, in limited quantities but with a definite minimum tooling cost. Such wrenches can be made of practically any sheet alloy, and can be furnished with or without heat-treating. Wrenches to 22 inches in length, varying in material thickness from minimum to $^3/_8$ inch, can be accurately produced under this process, with a finish free from burrs, with rounded edges assured for practical handling and application. The over-all tooling cost on special custom-made wrenches runs from 10 to 15 percent of the cost of conventional tooling, thus making it possible to make die-cut

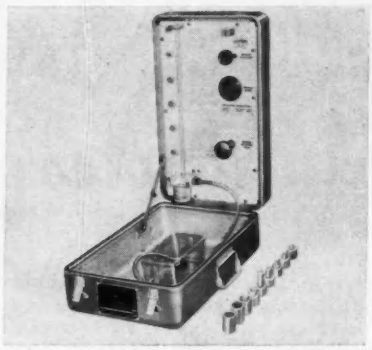


custom-made wrenches in either small or large lots, at a minimum cost. On the wrenches shown, the contour and dimensional tolerances are held to a maximum plus or minus 0.005. Closer tolerances can be obtained on thinner wrenches. *Dayton Rogers Manufacturing Company,* 2824 Thirteenth Avenue, S. Minneapolis 7, Minn.

Z-100, Z-200, B-100 and F-100 comprise a line of piezoelectric and ferromagnetic ceramic materials. Z-100 is an advanced modified lead zirconate titanate with three major advantages: temperature stability, high strain capacity and high driving sensitivity. It increases reliability and efficiency of power transducers in sonar devices, missile components, medical equipment, ultrasonic cleaning equipment and other systems using piezoelectric elements. Uniquely suited for high power transducers because of a Curie point (the point below which a substance ceases to be paramagnetic) of 300° C, Z-100 does not self-

heat appreciably when electrically driven to high strain amplitudes. Z-200 is another polycrystalline modified lead zirconate ceramic. It has two major advantages: temperature stability and high generating sensitivity. It reportedly provides transducer elements with a higher electromechanical coupling than other piezoelectric material and is particularly suited for high sensitivity hydrophones. A Curie point above 300° C makes it suitable for use in sensing devices in a wide range of conditions. B-100 is an improved barium titanate with additives that stabilize the piezoelectric characteristics. Reliable and economical, the material is useful for crystal applications where high driving sensitivity and high operating temperatures are not critical. F-100 is a piezomagnetic ferrite that was developed to replace nickel in magnetostrictive transducers. Among its advantages are high electroacoustic efficiency and economy. No critical materials are used in its manufacture and it can be fabricated in a wide range of shapes and sizes. It has a Curie point beyond 500° C and can be used in electric wave filters, high temperature liquid level sensors, sonar transducers, ultrasonic transducers, and ultrasonic soldering transducers. *Technical Dynamics Inc.*, 415 E. Montecito Street, Santa Barbara, Calif.

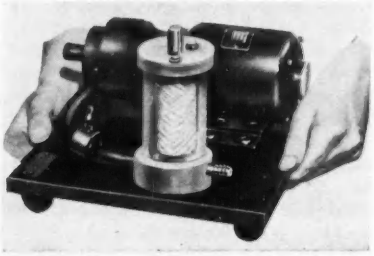
THE PORTABLE self-contained test unit shown here provides rapid and accurate measurement of the largest opening in a filter element, according to the manufacturer. The Bubble Point Test Stand, as it is called, detects damaged or otherwise imperfect filter elements prior to installation in an aircraft, missile or ground system. In addition it may be used for measuring orifice diameters, checking seating of valves, and, in general, wherever the magnitude of a small opening is to be determined. The only connection required for operation is shop air at 6- to 250-psig pressure. Each unit contains an air filter and regulator, as well as all necessary controls. Testing of filter elements is simple and quick. Complete instructions are included on



the control panel, and settings corresponding to the desired "maximum particle passed" are listed on a plate which is made up to the specific requirements of each customer. Detection range of the instrument is from 13 to 120 microns. The stand is designed to accommodate most common sizes of filter elements directly, and others through the use of adapters. Elements to 18 inches in length and 4 inches in diameter (or 10 inches in width) can be tested in the lower half of the case. The unit is pictured here with several adapters. *Pall Corporation*, Aircraft Porous Media, Inc., 30 Sea Cliff Avenue, Glen Cove, N. Y.

AN EXCLUSIVE cam control design to assure greater vari-speed efficiency is a feature of a series of wide V-belt pulleys rated at 1 to 5 hp, at 1750 rpm. They provide instantly variable ratios to 3:1. Each pulley face is independently actuated by its own spring and cam assemblies. The opposite wedging action of each cam and cam follower prevents pulley spread. This assures constant speed, even under overload conditions. The cam action also automatically compensates for tension and alignment to keep the belt constantly in proper alignment and never under more tension than required by the load, according to company reports. The springs are not driving members but serve only to keep pulley faces in contact with the belt for smooth and steady transmission of power. Spring assemblies also are designed to prevent excessive spring pressure and assure longer service life for belts. Known as Models 1060, 1160, 1390 and 1590, the pulleys are built by Hi-Lo Manufacturing Company, an affiliate of Lovejoy Flexible Coupling Company. *Lovejoy Flexible Coupling Company*, 4949-H W. Lake Street, Chicago 44, Ill.

LABORATORIES, pilot plants and process industries working with small volumes of corrosive and expensive solutions, or solvents requiring constant circulation or freedom from solid particle contamination, are finding Sethco Model LAI-1 useful. It combines a miniature fullview lucite filter chamber with a miniature epoxy centrifugal pump. Powered by a 1/40-hp continuous-duty motor, all the components are mounted on an 8x9-inch phenolic panel. Since the unit is complete with filter tube, vinyl hose and



electric cord, it can be plugged into any 2- or 3-wire, 110-v, a-c outlet for immediate operation. Capacity is 180 gph on open pumping and the company reports that the model illustrated will keep a 10-gallon tank vigorously agitated or filtered. (A companion model is larger

and is used on tanks to 25-gallon size.) Bulletin 602 containing complete details and prices is available on request. *Sethco Manufacturing Corporation*, 2284 Babylon Turnpike, Merrick, Long Island, N. Y.

PROCESS and project engineers were in mind when two booklets that detail Snap-Tite's E and H couplings were written. The former is for use in high-pressure, gravity-flow and vacuum systems; the H model is used primarily in hydraulic lines. The brochures include a complete catalog of spare parts, accessories, and suggested methods of using the couplings. Designated 240-61 and 250-61, both booklets are available without charge. *Snap-Tite, Inc.*, Union City, Pa.

EMBODYING the Hydro-Air principle is this versatile assembling and arbor-type press. According to the manufacturer, the units have proved successful for many years in pressing machines. Among the advantages pointed out by Pantex engineers are:

(1) The ram is lowered with light pressure to permit instant clamping of work for alignment or preadjustment prior to the application of high pressure under sensitive finger tip control.

(2) The initial light pressure insures safety for the operator.

(3) The adjustable high pressure exerted by the ram is indicated on a dial,

permitting precise quality standards control.

(4) The ram stroke is adjustable to 8 inches, limiting air consumption to actual production requirements.

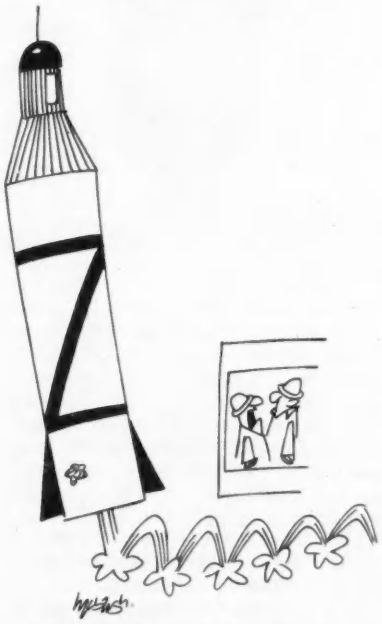
(5) The maximum open height is 15 inches, throat depth is 8 inches.

(6) Automatic cycling can be provided if required.

(7) No electrical connections are needed, just connections to shop air lines. *Pantex Manufacturing Corporation*, P. O. Box 660, Pawtucket, R. I.

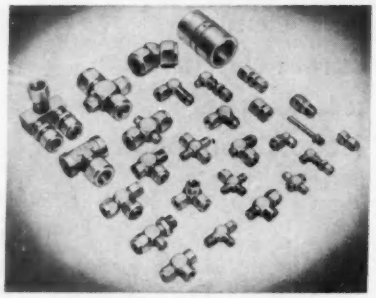
TUBE-VEYOR is a totally enclosed bulk-handling conveyor that has proved itself in hundreds of applications throughout the world. Materials handled vary from steel chips and ball bearings, to plastic, rice and starch. The conveyors feature a 2-directional heat-treated chain that conveys material in any direction without transfer points. Two-piece flights allow changes of flights without disassembly of chain. Flight material can be metal or nonmetallic. The system is totally enclosed, but can be fed and discharged at as many points as desired. High temperature and close quarters are said to be no problem. Uses of Tube-Veyor systems that may be advantageous to the reader are discussed in Prab's brochure TV-98, which is available without charge. *Prab Conveyors, Inc.*, 30121 Groesbeck Highway, Roseville, Mich.

UTILIZING the characteristics of Lenz O-ring seals in which seal and grip are separate, the Lenz Company manufactures a wide range of fittings to order in special shapes, sizes, finishes and materials. A few variations in crosses, tees, elbows, unions, elbow-unions, connectors and lateral elbows, tees and crosses that facilitate the solution of difficult or special design problems are shown in the accompanying picture. All conform to J.I.C. hydraulic standards. The exclusive separate seal and grip design solves many tube fitting problems because there is no damage to the tube through solder-



"You had to stick that gum on for good luck?"

ing, flaring, threading or scoring. The tube reportedly is not weakened, work-hardened or crystallized, and there is no broaching point or concentration of stress. All parts are reusable. The special fittings, as well as standard ones, are available in cadmium-plated steel, black phosphate, stainless steel or other materials. Engineering services are offered in response to inquiries for any special shape, size, material, or in the solution of hydraulic fitting problems. *The Lenz Company,* 3301 Klepinger Road, Dayton 1, Ohio.



AIR-MAZE has developed what it claims to be a 98-percent-efficient, self-cleaning lint arrestor for removing heavy concentrations of lint and fibrous material from air in high-volume applications. Called Lint-A-Maze, the automatic filtering and collection device is available in a wide range of sizes to meet specific air flow requirements from 7000 to 150,000 cfm. Extremely low pressure drop and high arresting efficiency with velocities of 250 to 1900 feet per minute are features of the new machine. Exact pressure drop depends on which of three standard arrestor media is used. Lint, chaff, leather cuttings, feathers and similar wet or dry materials can be removed from air by the new filtering mechanism, which can also be used in conjunction with fine-particle filtering equipment. A powered sweeper brush continuously removes collected material from the face of the filter media and deposits it in a hopper. Sizes of standard models range from a little larger than 2 feet wide and 4 feet high to about 21 feet wide and 10 feet high, exclusive of hoppers and other apparatus. *Rockwell-Standard Corporation,* Air-Maze Division, 25000 Miles Road, Cleveland 28, Ohio.

THIS filter for vacuum service has a large impregnated felt cartridge that is reusable. Model 1125 MV, as it is designated, is said to be capable of removing particles as small as 5 microns in size without restriction to the vacuum flow. Oil fumes can also be removed. These units will handle flows to 4000 cfm and are equipped with a petcock for draining the large sumps. They are available from stock in threads of $1/4$ inch to 2 inches, and with flanges to 8 inches. *Wilkerson Corporation,* 1645 W. Mansfield, Englewood, Colo.

WEAR and tear on hoses and cable in Mig and Tig welding has always been a costly problem. The Singer Glove Manufacturing Company has designed a neoprene-coated sleeve that practically eliminates expensive repairs and replacements. It comes in lengths to fit 9-,

12½- and 25-foot standard cable sizes and has a sturdy zipper for easy application. Named C. H. P. (cable and hose protector) this ingenious sleeve protects

lines from damage caused by falling objects, trucks and kicks, as well as normal deterioration. *Singer Glove Manufacturing Company,* Special Products Division, 860 W. Weed Street, Chicago 22, Ill.

HEAT exchangers, aftercoolers and air filters are the subjects of Bulletin No. 715, released by R. P. Adams Company. It details the operation of the firm's Economat, which is said to give more usable volume to compressed air; and lists complete specifying data and prices on compressed air filters. *R. P. Adams Company, Inc.,* 309 E. Park Drive, Buffalo 17, N. Y.

Books . . .

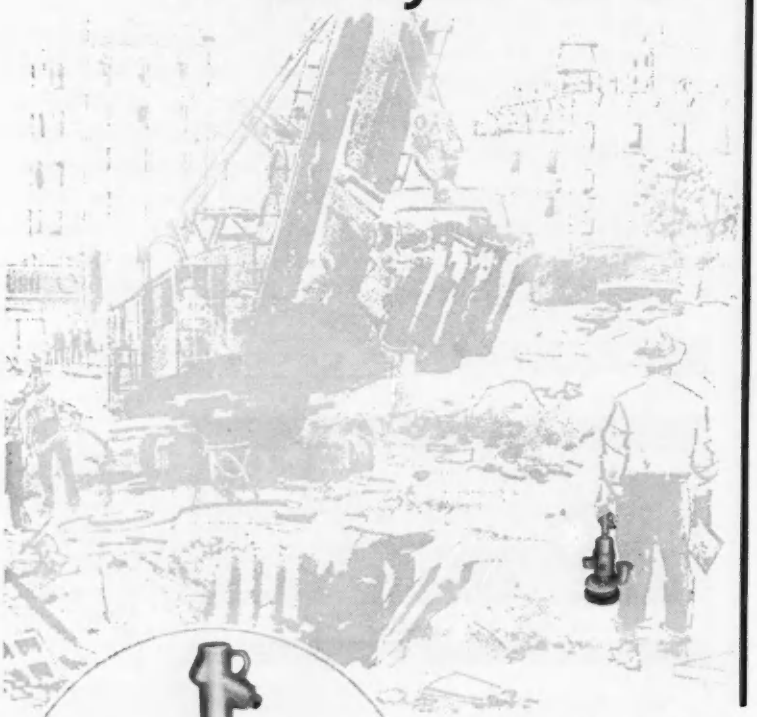
Underwater Swimming (published by Technical Information Division, U. S. Department of Commerce, Washington 25, D. C.) is a comprehensive annotated bibliography listing U. S. and foreign literature on swimming, skindiving, construction and salvage diving, underwater photography and other marine subjects, including discussions of the military and civilian diver's health hazards. Compiled by the Library of Congress for the Office of Naval Research, the publication has been released through the Office of Technical Services—order number PB 171 577. The cited literature ranges from discussions of ear plugs for the underwater swimmer to the use of midget submarines; from the diver's problems with eels and sharks, to equipment for the diver with false teeth. 230 pages. Cost, $3.

NEW BANTAM IR PUMP

...a boon to contractors

...utility crews!

an Ingersoll-Rand exclusive! NEW—automatic constant lubrication of water seals from a pressurized grease reservoir in the housing!



Ingersoll-Rand
Size 225 Air
Operated Sump Pump

An easy 34 lb. load for one man, and only 16 in. high, this new baby of the Ingersoll-Rand Pump Line can move 190 gallons per minute against a 15 ft. total head.

The new I-R 225 Pump is ideal for pumping water, oil, sewage or sludge out of sumps, trenches, manholes, tanks and bilges.

Other newly designed features include a more efficient and longer lasting multi-vane motor, stainless steel parts at critical locations to prevent corrosion, and a rugged alloy housing and impeller.

Standard equipment includes exhaust hose assembly, air strainer and air throttle valve.

For details or an on-the-job demonstration, call your nearby Ingersoll-Rand representative or write: Ingersoll-Rand, 11 Broadway, New York 4, N. Y.

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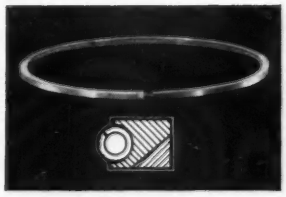
219A-18

Caterpillar selects Koppers piston and sealing rings for use in the world's largest single engine crawler tractor.

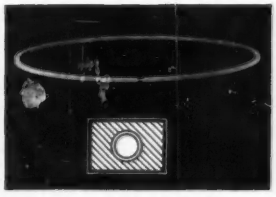
A brute of a tractor for brute force jobs, Caterpillar's D9 Series E Tractor applies a 335 HP engine which combines the versatility and economy of diesel power with the power boosting efficiency of a turbocharger. Traditional Caterpillar durability is built into every part. And in the power shift transmission sealing rings, chrome plated malleable iron compression rings, crankshaft seals, and steering control seals, that durability spells K-O-P-P-E-R-S.

Says Caterpillar: "The D9 Tractor is ruggedly built for long life under the most severe operating conditions. In addition, special attention has been given to insure the production of a power plant that is easy and economical to operate and maintain. On all these counts, the Koppers rings and seals we have selected meet our requirements of quality and dependability."

Write today for 8 page brochure on metallic sealing rings to: KOPPERS COMPANY, INC., Piston and Sealing Ring Department, 6108 Hamburg Street, Baltimore 3, Maryland.



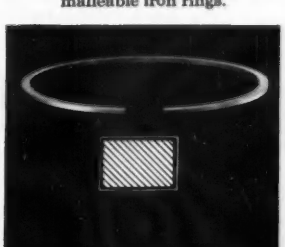
CRANKSHAFT SEALS: Application of a conformable step seal ring (specially designed for Caterpillar) establishes a *permanent* crankshaft seal, reliable for the life of the engine.

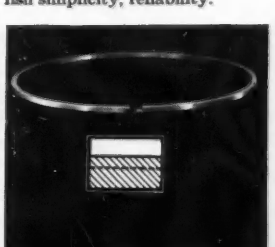


TRANSMISSION SEALING RINGS: Specially designed metallic sealing rings transmit fluid power to the rotor and actuate the clutches of Caterpillar's dramatic new power shift transmission.

COMPRESSION RINGS: Dependable performance at the most critical point in the combustion chamber is assured by chrome plated malleable iron rings.

STEERING CONTROL SEALS: Caterpillar's new design steering control requires a rotating, high pressure seal. Piston ring type seals establish simplicity, reliability.





KOPPERS

PISTON & SEALING RINGS

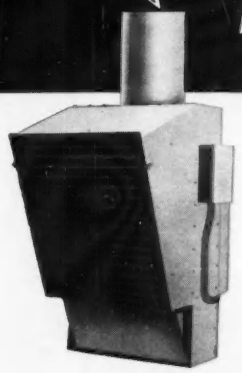
Engineered Products Sold with *Service*

Reduce maintenance...increase equipment life

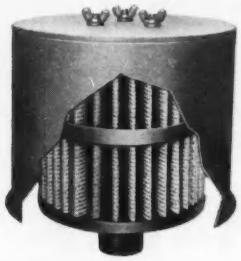
with

AIR-MAZE FILTERS

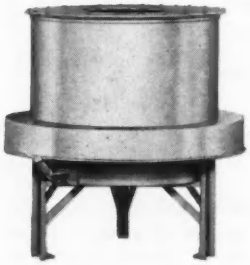
There's one to meet every need!



AIR-MAZE AUTOMAZE—the automatic, self-cleaning impingement type filter for heavy-duty use. A constantly moving curtain of viscous-coated double filter panels traps air-borne particles. Panels are thoroughly cleaned and recoated by passing through an adhesive bath. Filters consist of layers of crimped galvanized steel wire screens of selected meshes. Available in all capacities with or without weather louvres or plenums. Air or electric drive optional.



AIR-MAZE "DA" DRY-TYPE FILTER—laboratory tested for better than 98% efficiency with particles of 2 micron mean diameter, practically 100% with particles 5 microns or larger. Corrosion resistant, designed for use up to 6650 cfm. Filter media is heavy, deep-pleated wool felt flanked by sturdy galvanized steel cloth. Element can be cleaned with a commercial solvent or by blowing off with compressed air.



AIR-MAZE OIL BATH FILTER—the low-pressure-loss way to oil wash intake air. Offers a distinct engineering advancement because it provides low static pressure drop without requiring any outside energy. Removes practically all fine abrasives and dirt! No moving parts, nothing to wear out, easier servicing! Made of rugged, heavy gauge steel coated with enamel. Available in capacities up to 20,000 cfm.

Write for latest bulletins on AIR-MAZE complete line of air and liquid filters and intake silencers for all types of large engines and compressors.

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CLEVELAND 28, OHIO
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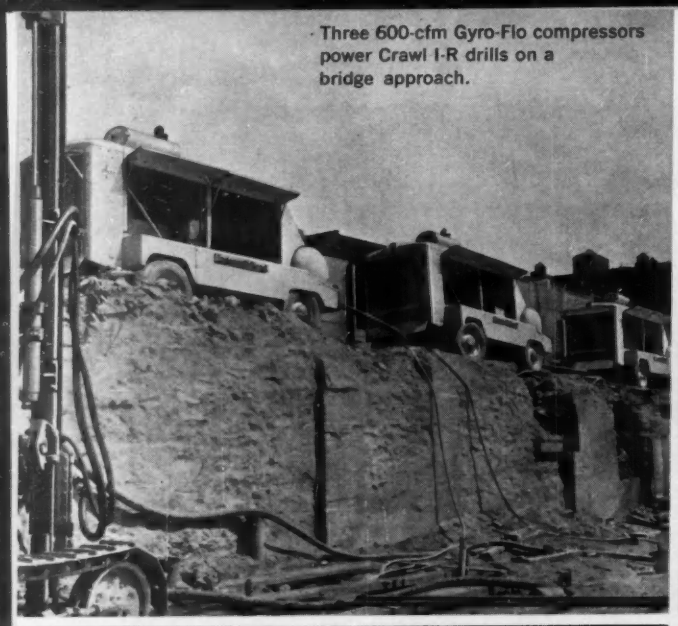

Three 600-cfm Gyro-Flo compressors power Crawl I-R drills on a bridge approach.

This 600-cfm Gyro-Flo and Crawl-IR drill speed blasting on a quarry contract.

This 250-cfm Gyro-Flo provides dependable air power for an industrial construction job.

A pile driver gets plenty of power from this 900-cfm Gyro-Flo portable.

Why cost-conscious contractors

DEPEND ON GYRO-FLO

From long experience they know that a Gyro-Flo portable compressor can *always* be depended on for top performance with little or no "down-time"... low fuel consumption, low lube oil requirements and exceptionally low maintenance!

Gyro-Flo *dependability* is a matter of record—proved by 10 years of performance on major contracts from coast to coast.

Available in sizes from 85 to 900 cfm, Gyro-Flo portables provide 100-psi air power for every type of construction or maintenance work. Whatever the job, you can *depend on Gyro-Flo.*

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GYRO-FLO

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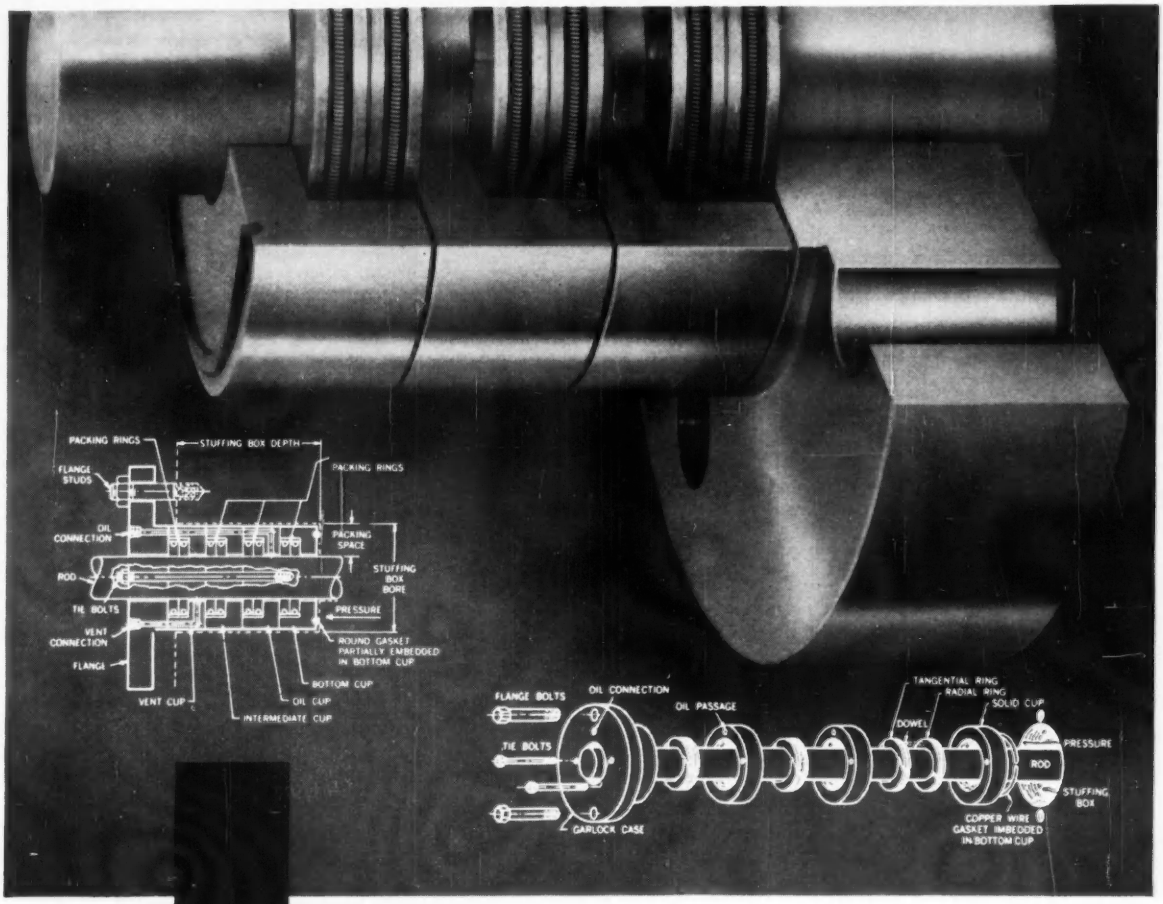

GARLOCK METAL PACKING

proved superior for air and gas compressors

For packings that offer a tight, leak-proof seal . . . for packings that keep compressor rods leak-free for years . . . for packings that need little or no attention after installation . . . specify engineered Garlock Metal Packings.

Packing rings super-finished to a flatness measurable in light bands. Only Garlock gives you such precision finishing—such a positive seal between ring and groove. And, thanks to an exclusive Garlock manufacturing technique, this super-finish is yours without additional cost.

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These rugged standards must be met by every Metal Packing Set leaving the Garlock factory:

1. Gas-tight seal between rings and compressor rod.
2. Gas-tight seal between rings and packing groove.
3. Packing must not be affected by operating conditions.
4. Operating conditions must not be affected by packing.
5. Packings must have no adverse effect on compressor rod.

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Canadian Div.: Garlock of Canada Ltd. **Plastics Div.:** United States Gasket Company. **Order from the complete line** of quality Garlock products . . . Packings, Gaskets, Seals, Molded and Extruded Rubber, Plastic Stock and Parts.

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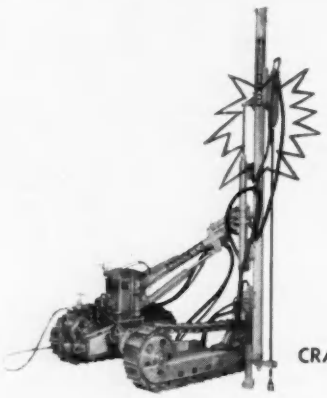
GARLOCK

Here's the Drill to beat!

New D-475 HIGH PRODUCTION MACHINE

- ***MOST HOLE PER SHIFT***
- ***MOST RUGGED DESIGN***
- ***MOST POWERFUL ROTATION***



CRAWL-IR

A GREAT MACHINE NOW EVEN GREATER

The new D-475 drifter was designed to give you a drill in the 2-¾ to 4 inch hole size that will increase penetration up to 35%, stay in operation longer and provide a balanced rotation not subject to the whim of the operator. This heavy-duty super powered drill, with built-in reversible rotation, has a new, more efficient double kicker port spool valve that enables it to provide the full power of which the Gyro-Flo 600 cfm compressor is capable.

New integral rotation with rugged longer-lasting full pawl engagement gives the right combination of rotation and impact for maximum drilling efficiency, gives longest steel and coupling life using standard SPI-RAL rods and prevents over-rotation which cuts bit life. Drill rotates only on up-stroke of piston, avoiding rapid bit wear from rotation during impact. Larger, 9/16" straight-through blower tube admits more air for more effective hole cleaning.

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